REVA UNIVERSITY
Bengaluru, India

SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

HANDBOOK

B. Tech. in Electronics and Communication Engineering

2023-27

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Rukmini Educational
Charitable Trust

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Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of Reva University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Director's –Message

Since the inception of REVA University, School of Electronics and Communication Engineering is involved in implementing following best practices in various dimensions such as academics, research, outreach activities, student development programs, project based and research based learning, student centric learning, student competitions, industry and in-house internships, abroad internships, skill enhancement activities, motivation for competitive exams, mini projects, major projects, industry mentored projects, multidisciplinary projects, industry visits, technical talks by industry and academicians, certification programs, etc. Individual students are taken care by strong mentoring system wherein faculty members are not only allotted as mentors to students, but also they will act as local guardians and they will have constant follow up with mentees in regard to academic and personal issues till students complete the degree.

The curriculum is carefully designed to meet the current industry trends and also to provide insight into future technology developments that lead to inculcate lifelong learning abilities in students. Board of Studies (BoS) comprises people from academics, industry, alumni and current students which form the strong backbone for our programs wherein constant updates happen in contents/subjects every semester based on current industry needs. Curriculum has good mix of foundation courses, hardcore courses, softcore courses, practical and projects along with open electives on par with global education standards.

Student's welfare is given utmost priority at School of Electronics and Communication Engineering. Advanced learning methods are adopted to make learning truly interactive. More focus is on discussion and practical applications rather than rote learning. Notes/handouts/video contents/quizzes are given and critical thinking questions are asked to test understanding. Experienced, well qualified and friendly faculty members always strive hard to provide best of education to students. The faculty members have number of publications in reputed national and international journals/conferences. The school is also involved in funded research projects.

I am sure the students choosing B Tech and M. Tech programs in School of Electronics and Communication Engineering in REVA University will enjoy the curriculum, teaching and learning environment, well equipped laboratories, digital classrooms infrastructure and the experienced teachers involvement and guidance.

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. **Rukmini Educational Charitable Trust** (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines.

The curriculum of each programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous

Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Sensor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced

Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVOTSAVA conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga class's everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Vision

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standard.

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

ABOUT SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

The School of Electronics and Communication Engineering headed by a highly experienced Professor and is supported by well qualified faculty members. The school has the state-of-art class rooms and well equipped laboratories. It offers B. Tech. and M. Tech. and PhD programs in various specialized streams. The curriculum of both the graduate and the post graduate degree programs have been designed to meet the current industry trends. B. Tech program aims to prepare human resources to play a leading role in the continuing adventure of modern automated systems and communications. The program offers numerous choices of study for the students based on interest in the current state of art technology. Apart from fundamental courses in Electronics and Communication Engineering, the school facilitates to study in four streams such as Circuits and Devices, Communication Engineering, Signal Processing and Programming. Students are at liberty to choose from these streams in higher semesters. This is reflected in various core subjects offered within the program.

The Master degree programs focus on research and design in the core and IT industries, building and marketing the next generation of product development. These programs provide an opportunity to explore newer dimensions in cutting edge technologies like Electronic Circuits and Communication, Signal Processing and Computer Networks, VLSI and Embedded Systems and pursue research in interested domains for doctoral degree.

Vision

The School of Electronics and Communication Engineering is envisioned to be a leading centre of higher learning with academic excellence in the field of electronics and communication engineering blended by research and innovation in tune with changing technological and cultural challenges supported with leadership qualities, ethical and moral values.

Mission

- Establish a unique learning environment to enable the students to face the challenges in the field of Electronics and Communication Engineering and explore multidisciplinary which serve the societal requirements.
- Create state-of-the-art laboratories, resources and exposure to the current industrial trends to enable students to develop skills for solving complex technological problems of current times and also provide a framework for promoting collaborative and multidisciplinary activities.
- Promote the establishment of Centers of Excellence in niche technology areas to nurture the spirit of innovation and creativity among faculty and students.
- Offer ethical and moral value based education by promoting activities which inculcate the leadership qualities, patriotism and set high benchmarks to serve the society.

Programme Overview

The B. Tech in Electronics and Communication Engineering is designed keeping in view the current situation and possible future developments, both at national and international levels. This course is designed to give greater emphasis on core Electronics and Communication Engineering with a flexibility to explore any one of the four areas like circuits and devices, signal processing, communication engineering and programming where in an ample number of courses that provide knowledge in these specialized areas. This facilitates the students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts and support to explore the areas of their interest.

In recent past, Electronics and Communication Engineering is emerged as bridging course that connects the technologies from core Electrical Engineering and Semiconductor Physics to the modern technologies such as VLSI Circuits, seamless high bandwidth communication, advanced signal processing, and finally, merging all the hardware devices of these technologies with IT. The structure of the course has undergone a face-lift with the introduction of subjects from computer science and engineering and thereby provides the flexibility for students choose for IT sectors apart from core Electronics and Communication Engineering. Thus, students in Electronics and Communication Engineering have the flexibility to broaden their horizons in software related industries. The advantage for Electronics and Communication Engineering students is that they are required in both hardware development sectors as well as software development sectors that broadens the area from core electrical engineering to multidisciplinary areas such as robotics, mechatronics, aviation, medical electronics, space exploration, etc.

The program is thus designed to expose students to various subjects having applications in VLSI design, smart system design, wired and wireless communication technologies, information processing, security systems, control engineering, power electronics, cloud based applications, information technology and electronics related industries through outcome based teaching and learning process which emphasizes practical exposure rather than memorization. A variety of activities such as mini projects, seminars, interaction with industries, cultural activities and social activities are in place to shape the all-round development of students. Electronics and Communication Engineering provides the students to choose their career in any one of the following areas.

1. *Analog and Radio Frequency Electronic Circuits:* Without these, there would be no cell phones, no Wifi, not even television.
2. *Communication and Signal/ Image Processing:* It is concerned with the transmission, storage, and analysis of information signals. While traditionally electronics engineers worked on communicating and analyzing speech, audio, image, and video signals, nowadays they work on a much wider variety

of problems, such as recovering and analyzing physiological and genomic signals, ecological and environmental signals, consumer preference data, financial time series, and many others. These technologies make it possible for computers to analyze data from magneto-resonance imaging and other medical imaging devices to not only display images but identify diseases. Computer vision experts teach computers how to recognize faces, while image processing people can de-blur images, extract features, and even make art.

3. *Computer and Digital Systems:* Our society is advancing faster technologically than ever before with the help of computers. These digital systems are everywhere, from your dishwasher and wristwatch to the Mars rovers, and everything in between.
4. *Networking:* The Internet is having a profound impact on society, bringing people across the world together to work collaboratively from different countries. It also spreads and promotes democracy.
5. *Control Systems, Robotics, and Intelligent Transportation:* Automation to reduce human toil in the workplace; enhance safety in manufacturing systems, automobiles (via anti-skid braking systems or self-driving vehicles), and aircraft (e.g., via auto-pilots); biomedical applications including automatic drug delivery (e.g., insulin control for diabetics), controlled prostheses, and robotic surgery; pollution reduction in automobiles and aircraft.
6. *Electromagnetics and Microwaves:* Communication via radiowaves is essential for mobile devices, radios, and the internet. Radio- and microwaves can also be used for sensing, for example in air traffic control radar. The ability of microwaves to see through clouds and rain also makes them very useful for measuring Earth's climate and the influence of global change.
7. *Fibre Optics:* Using light to solve engineering problems runs the gamut from fiber optics to lasers for eye surgery. A thorough understanding of the interaction of light with matter even helps animators creativity. Optics are widely applicable in many fields, including all types of engineering, as well as medicine, architecture (lighting), entertainment, and many others.

The benefits of choosing Electronics and Communication Engineering are as follows.

- Ample opportunities exist in the field of embedded systems, signal processing, and communication enginnering jobs including the IT sector. Flexibility to choose various fields upon graduation
- Great number of opportunities also exists in the field of defense to work in the areas of signal processing and communication.
- Provides a platform to venture into a startup and establish as an entrepreneur.
- Provides a platform to focus on the research and innovation which leads to socio-economic reforms.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. Tech. (Electronics and Communication Engineering) will be:

- **PEO-1:** To have successful professional careers in industry, government, academia and military as innovative engineers.
- **PEO-2:** To successfully solve engineering problems associated with the lifecycle of Electronics and Communication Systems by communicating effectively either leading a team or as a team member
- **PEO-3:** To continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification for lifelong learning and seeking higher education.
- **PEO-4:** To be active members ready to serve the society locally and internationally and will take up entrepreneurship for the growth of economy and to generate employment.

Program Outcomes (POs)

On successful completion of the program, the graduates of B. Tech. (Electronics and Communication Engineering) program will be able to:

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Electronics and communication Engineering.
- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO-9: Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

On successful completion of the program, the graduates of B. Tech. (Electronics and Communication Engineering) program will be able to:

- **PSO-1:** Isolate and solve complex problems in the domains of Electronics and Communication Engineering using latest hardware and software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions either independently or as a team.
- **PSO-2:** Implant the capacity to apply the concepts of electronics, communications, signal processing, VLSI, embedded systems, etc. in the design, development and implementation of application oriented engineering systems.
- **PSO-3:** Design, Model, Analyze and Build Electronics and Communication Systems to solve real life and industry problems**.**

REVA UNIVERSITY
Bengaluru, India

REVA University Academic Regulations

B. Tech., Degree Programs
(Applicable for the programs offered from 2023-24)

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

THESE ACADEMIC REGULATIONS ARE UNDER CHOICE BASED CREDIT SYSTEM AND CONTINUOUS ASSESSMENT GRADING PATTERN (CBCS-CAGP)

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – B. Tech., Degree Program for the batch of students admitted for AY 2023-24 subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management"**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

2. The Programs:

These regulations cover the following B. Tech., Degree programs of REVA University offered for the admitted batch during AY 2023-24 under respective schools.

SL No.	Name of the School	Name of the Program
1	School of Civil Engineering	B Tech in Civil Engineering B Tech in Agriculture Engineering
2	School of Computing and Information Technology	B Tech Computer Science and Engineering (AI and ML)
		B Tech Computer Science and Information Technology
		B Tech in Information Science and Engineering
		B Tech in Computer Science and Systems Engineering
3	School of Computer Science and Engineering	B Tech in Computer Science and Engineering
		B Tech in Computer Science and Engineering (AI and DS)
		B Tech in Computer Science and Engineering (IoT, Cybersecurity and Blockchain)
4	School of Electrical and Electronics Engineering	B Tech in Electrical and Electronics Engineering
5		B Tech in Electronics and Communication Engineer

	School of Electronics and Communication Engineering	B Tech in Electronics and Computer Engineering
		B Tech in Robotics and Automation
c	School of Mechanical Engineering	B Tech in Mechanical Engineering
		B Tech in Mechatronics Engineering
		B.Tech in Aerospace Engineering

3. Duration and Medium of Instructions:

3.1 Duration: The duration of the B Tech degree program shall be **FOUR** years comprising of **EIGHT** Semesters. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both and project, listed under a program; Example: "Fluid Mechanics" in B. Tech Civil Engineering program, "Engineering Thermodynamics" in B. Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely, L, T and P, where,

L stands for **Lecture** session consisting of classroom instruction.

T stands for **Tutorial** session consisting participatory discussion/self-study/desk work/brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the lecture classes.

P stands for **Practice** session and it consists of hands-on experience such as laboratory experiments, field studies, case studies, project based learning or course end projects and self-study courses that equip students to acquire the required skill component.

4.2 Classification of Courses

Courses offered are classified as follows:

4.2.1 Foundation Course (FC): The foundation Course is basic course which should be completed successfully as a part of graduate degree program irrespective of the program of study.

4.2.2 Professional Core Course (also known as Hard Core(HC) Course): The **Professional Core** is a core course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily.

4.2.3 Professional Elective Course (also known as Soft Core (SC) Course): Professional Elective course is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study.

4.2.4 Open Elective Course (OE): An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course.**

4.2.5 Audit Course (also known as Non-Credit Course /Mandatory Course(MC)): These courses are mandatory for students joining B.Tech. Program and students have to successfully complete these courses before the completion of degree.

4.2.6 Project Work / Dissertation: Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems. The project will be conducted in two phases, phase-I, consists of literature survey, problem identification, formulation and methodology. In Phase-II, student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated.

4.2.7 Skill Development Course (SDC): It is a practice based course introduced in first year, second year and third year that lead to advanced job skills as per current industry/societal requirements to enhance high employability index of graduates. It may also lead to a certificate, diploma and advanced diploma, etc.

4.3 "Program" means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma Degree or such other degrees instituted and introduced in REVA University.

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to B Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B. Tech)	4 Years (8 Semesters)	Passed 10+2 examination with Physics and Mathematics as compulsory subjects, along with any one of the following subjects, namely, Chemistry, Bio-Technology, Computer Science, Biology, Electronics and Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology (B Tech)	3 Years (6 Semesters)	A. Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology. B. Passed B.Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. C. Provided that in case of students belonging to B.Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects. D. Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream. E. Provided further that student, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above. F. Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the program)
3	Bachelor of Technology (B Tech)		Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the

Sl. No.	Program	Duration	Eligibility
			concerned branch of study, provided he/she fulfils the University requirements.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning, CIA and the remaining 4 weeks for SEE, evaluation and result declaration.

6.3 The credit hours defined as below:
In terms of credits, L refers to lecture hour (theory) credit per week, that indicate every one hour lecture per week of L amounts to 1 credit per Semester; T and P refer to tutorial hours and practice hours credit per week, that indicate every two hours of T and P per week amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits per semester.

The total duration of a semester is 20 weeks inclusive of semester-end examination.
The following table describes credit pattern

Table -2: Credit Pattern

Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total Contact Hours
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course.

7. Different Courses of Study:

Different **Courses of Study** are labeled as follows:

a. Foundation Course (FC)

b. Professional Core Course (Hard Core(HC))

c. Professional Elective Course (Soft Core(SC))

d. Open Elective Course (OE)

e. Skill Development Course (SDC)

f. Audit Course (Non-credit Course/ Mandatory Course) (MC)

g. Project Work / Dissertation: A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated. These are defined under Section 4.2.6 of this regulation.

8. Credits and Credit Distribution

8.1 A candidate has to earn 168 credits for successful completion of B Tech degree with the distribution of credits for different courses with the credit distribution given in the scheme of study.

8.2 The concerned BOS based on the credits distribution shall prescribe the credits to various types of courses listed in section 4.2 and shall assign title to every course thereon.

8.3 Every course including project work, practical work, field work, self-study elective should be entitled as per the list declared in section 4.2. However, as per AICTE, the credit distribution for various category of courses is given below in the table.

Sl. No.	Course Category	Abbreviation (AICTE)	Abbreviation (REVA)	Suggested breakup of credits (AICTE)	Credit breakup (REVA)
1	Humanities and Social Sciences including Management courses (HSMC)	HSMC	FC	12	9
2	Basic Science Courses	BSC	FC	25	20
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	ESC	FC	24	29
4	Program core courses	PCC	PC	48	58

5	Program Elective courses relevant to chosen specialization/branch	PEC	PE	18	15
6	Open subjects – Electives from other technical and /or emerging subjects	OE	OE	18	12
7	Project work, seminar and internship in industry or elsewhere	PROJ	PC	15	18
8	Audit Courses (Mandatory Course)	MC	MC	-	-
9	Skill Development Courses (SDC)	-	SDC		07
TOTAL CREDITS				**160**	**168**

8.4 The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program. A candidate can enroll for a maximum of 26 credits and a minimum of 16 credits per Semester. However, he / she may not successfully earn a maximum of 26 credits per semester. This maximum of 26 credits does not include the credits of courses carried forward by a candidate.

8.5 Only such full-time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 168 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students.

8.6 Add- on Proficiency Certification:

To acquire Add on Proficiency Certification a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 168credits for the B Tech Degree program**.**

8.6.1 Add on Proficiency Diploma / Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree: a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 168 credits for the B Tech Degree program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so issued to the candidate contains the courses studied and grades earned.

9 Assessment and Evaluation

9.1 The Scheme of Assessment will have two parts, namely;

i. Continuous Internal Assessment (CIA); and
ii. Semester End Examination (SEE)

9.2 Assessment and Evaluation of each Course shall be for 100 marks. The CIA and SEE of UG Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

9.3 The 50 marks of CIA shall comprise of:

Internal Assessment Test	40 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes, etc.	10 marks

9.4 There shall be **two Internal Assessment Tests** are conducted as per the schedule announced below. **The Students' shall attend both the Tests compulsorily.**

- 1st test is conducted for 20 marks during **8th week** of the Semester;
- 2nd test is conducted for 20 marks during **15th week** of the of the Semester;

9.5 The coverage of syllabus for the said tests shall be as under:

- Question paper of the **1st test should be based on first 50% of the total syllabus(Unit 1 & 2)**;
- Question paper of the **2nd test should be based on remaining 50 % of the total syllabus (Unit 3 & 4)**;
- An assignment must be designed to cover the entire syllabus

9.6 There shall be two Assignments / Project Based Learning / Field Visit / Quiz test carrying 10 marks covering the entire syllabus.

9.7 SEE for 50 marks practical exam shall be held in the 16th and 17th week of the semester.

9.8 SEE for 50 marks theory exam shall be held during 18th 19th and 20th week of the semester and it should cover entire syllabus.

9.9 Internal test paper is set for a maximum of 40 marks to be answered in 1.5 hours duration (for 1 credit course, exam is conducted for 25 marks with a duration of 1 hour). A test paper can have 5 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totaling 10 marks. Students are required to answer any 4 main questions. Each

question is set using Bloom's action verbs. The questions must be set to assess the course outcomes described in the course document even with the choice is given in questions.

9.10 The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by the Question Paper Scrutiny Committee (internal BoE members) to bring the quality and uniformity in the question paper.

9.11 The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

9.12 Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarize the answer from web or any other resources. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.

9.13 Internal assessment marks must be decided well before the commencement of SEE.

9.14 SEE theory question paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have a 3 to 4 sub-questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's action verbs. The questions must be set to assess the students outcomes described in the course document (question papers have to be set to test the course outcomes).

9.15 There shall be minimum three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the question paper sets shall be scrutinized by the Board of Examiners (BoE). It shall be responsibility of the BOE particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

9.16 There shall be single evaluation by the examiners for each paper. However, there shall be moderation by one of the senior examiners, either internal or external.

9.17 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

9.18 There shall also be an **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and

declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. The Examination Review Committee shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

9.19 The report provided by the Examination Review Committee shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program.

9.20 During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC

9.21 University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper.

9.22 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor.

9.23 Online courses may be offered as per UGC norms.
For online course assessment guidelines would be as follows:

a. If the assessment is done by the course provider, then the School can accept the marks awarded by the course provider and assign the grade as per REVA University norms.

b. If the assessment is not done by the course provider then the assessment is organized by the concerned school and the procedure explained in the regulation will apply.

c. In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits.

IAs for online courses could be avoided and will remain at the discretion of the School.

9.24 The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

9.25 Utilization of one or two credit online courses would be:

4 week online course – 1 credit

8 week online course / MOOC – 2 credits

12 week online course / MOOC – 3 credits

9.26 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below (for theory courses having Credits >=2).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Scaled down to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	40	20	9th week
2	Test -2	During 15th Week	Remaining 50%	40	20	16th Week
3	Assignment 1/ Quiz - 1	Every week till Test-1	First 50%	10	05	9th Week
4	Assignment 2 / Quiz - 2	Every week during Test-1 and Test-2	Remaining 50%	10	05	16th Week
5	SEE	18th to 20th Week	100%	100	50	20th Week

9.27 Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below (for theory courses having Credit 1).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8th week	First 50%	25	12.5	8th week
2	Test -2	During 15th Week	Remaining 50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

10 Assessment of Students Performance in Practical Courses

Lab courses are of two types: integrated labs and separate labs.

The performance in the practice tasks / experiments shall be assessed on the basis of:

a. Knowledge of relevant processes;
b. Skills and operations involved;
c. Results / products including calculation and reporting

10.1 Assessment of lab courses

10.1.1 Assessment of Separate lab course

The 50 marks of CIA is based on the performance of students in each lab experiment for a lab course that shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	20 marks
	Total	**50 marks**

10.2 Assessment of integrated lab course

The 10 marks meant for CIA is based on the performance of students in each lab experiment for integrated lab course that shall further be allocated as under.

Integrated lab is evaluated and awarded marks meet the requirement of assignment/quiz/field work component of respective theory course having integrated lab component. No separate assignment/quiz/filed work is assessed for such courses.

i	Conduction of regular practical / experiments throughout the semester	05 marks
ii	Maintenance of lab records and performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	05 marks
	Total	**10 marks**

10.3 The 50 marks meant for SEE in case of separate lab course shall be allocated as under:

i	Conduction of practical (experiment)	30 marks
ii	Write up about the experiment/tabulation/results/inference	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

Note: No Separate SEE for integrated lab course

10.4 The duration for semester-end practical examination shall be decided by the concerned School Board.

10.5 For MOOC and Online Courses assessment shall be decided by the BOS of the School.

For >= 2 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
	Total	**100 marks**

For 1 credit courses

i	IA (Performance of internal test to be conducted after completion of entire syllabus)	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	25 marks
	Total	**50 marks**

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

12. Evaluation of mandatory courses: Students should maintain minimum of 75% attendance to appear for SEE of Mandatory course. The SEE should be conducted in MCQ pattern and students should get minimum pass grade to obtain the degree. There is no internal assessment

13. Evaluation of **Skill Development Courses:** The concerned BoS shall recommend to conduct test/demo/viva-voce/MCQ to test the student knowledge.

14. Requirements to Pass a Course:

A candidate's performance from CIA and SEE will be in terms of scores, and the sum of CIA and SEE scores will be for a maximum of 100 marks (CIA = 50 , SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 30% (15 marks) out of 50 marks in SEE, which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the

subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks scored in each course by the student (P = marks scored {CIA(50) + SEE(50)}) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

a. Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).
The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) = ∑(Ci x Gi) / ∑Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12

Course 7	3	O	10	3X10=30
	19			159

Thus, **SGPA = 159 ÷ 19 = 8.37**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
Course 7	2	B+	7	2X7=21
Course 8	2	O	10	2X10=20
	24			175

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

Course	**Credit**	**Grade Letter**	**Grade Point**	**Credit Point (Credit x Grade point)**
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (168) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : **CGPA = ∑(Ci x Si) / ∑Ci**

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	21	6.83	21 x 6.83 = 143.43
2	23	7.29	23 x 7.29 = 167.67
3	22	8.11	22 x 8.11 = 178.42
4	24	7.40	24 x 7.40 = 177.6
5	22	8.29	22 x 8.29 = 182.38
6	24	8.58	24 x 8.58 = 205.92
7	22	9.12	22 x 9.12 = 200.64
8	10	9.25	10 x 9.25 =92.50
Cumulative	**168**		**1348.56**

Thus,

$$\boldsymbol{CGPA} = \frac{\mathbf{21\times6.83+23\times7.29+22\times8.11+24\times7.40+22\times8.29+24\times8.58+22\times9.12+10\times9.25}}{\mathbf{168}} = \frac{\mathbf{1346.58}}{\mathbf{168}} = 8.02$$

c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.02 x 10=80.2

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index) G	Letter Grade	Performance	FGP Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

e. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA).**

f. Final Grade Card: Upon successful completion of B Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of

Examinations.

14.2 Attendance Requirement

14.2.1. All students must attend every lecture, tutorial and practical classes.

14.2.2. Student has to maintain a minimum attendance of 70% in each course (Theory and Practical) and 75% attendance in aggregate of all courses in a semester, with a provision of condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the Director of the School.

14.2.3. In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 65% of the classes taught.

14.2.4. Any student with less than 70% of attendance in individual courses of respective semester including practical courses / field visits etc., shall not be permitted to appear to SEE in the respective course.

15. Re-Registration and Re-Admission

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

16. Absence during Internal Test:

In case a student has been absent from an internal tests due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests

and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

17.1 Grievance Committee:

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances.

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

18. Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., and 70% attendance in each courses shall be eligible to appear for Semester End Examination

19. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 30% marks out of 50 (15 marks) in Semester End Examination (SEE) and a minimum of 40% marks (out of 100) together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

a. A student failed in any course is eligible to take supplementary exam under following category for each course: either to improve internal marks (IA1, IA2, and Assignment/Quiz), or to improve SEE.

b. Supplementary exam is permitted only during summer vacation (between even and odd semester break)

c. Eligibility to register for supplementary exam is that the student should have maintained pre-requisite attendance of ≥ 75% in respective semester.

d. No separate additional classes would be conducted for the students availing this facility.

e. Every student should pay the supplementary exam fee for each course as prescribed by the university.

20. Provision to Carry Forward the Failed Subjects / Courses:

Students who have failed in courses totaling 16 credits or fewer across both odd and even semesters combined will be allowed to proceed to the next semester of the following year(s) of their academic program.

For vertical progression, students have to clear all the courses of first year to be eligible to take admission to third year and they have to clear all the courses till second year to be eligible to take admission to fourth year. For lateral entry students, students have to clear all the courses of second year to be eligible to take admission to fourth year.

Case 1: A student who has failed in a maximum of 16 credits in 1st and 2nd semester together shall move to the 3rd semester of the succeeding year.

Case 2: A student who has failed in a maximum of 16 credits from semester 1 to 4 together shall move to the 5th semester of the succeeding year only if he/she successfully completes all the courses of first and second semester.

Case 3: A students who has failed in a maximum of 16 credits from semester 3 to 6 together shall move to the 7th semester of the succeeding year only if he/she successfully completes all the courses of third and Fourth semester.

21. Re-evaluation of Answer Scripts and Announcement of Re-evaluation Results

After declaration of the results of programs within next 10 days, if any candidate wishes to apply for Photocopy/Revaluation (only theory courses), s/he shall apply to the Controller of Examinations, by paying the prescribed fees notified by the University from time to time. The photocopies of the said answer books shall be made available within next TEN working days after the last date prescribed for receipt of the application at the Office of the Controller of Examinations. Photocopies will not be issued for practical/drawing/audit courses.

22. Results of Re-Evaluation will be announced within TWENTY working days (except for third evaluation).

23. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

24. All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

25. For lateral entry students, the minimum credits to be earned for the award of the degree would be the credits earned in 3 years from 2nd year to 4th year.

B. Tech in Electronics and Communication Engineering
Scheme of Instructions 2023-27 Batch

***Nomenclature*:** Lecture, **T:** Tutorial, **P:** Practical/Practice/Hands-on, **HC**: Hard Core, **SC**: Soft Core, **FC**: Foundation Core, **OE**: Open Elective, **SDC:** Skill Development Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination, **BSC**: Basic Science Course, **HSMC**: Humanities, Social science and Management Course, **ESC**: Engineering Science Course, **PCC**: Program Core Course, **PEC**: Professional Elective Course, **MC**: Mandatory Course, **PROJ**: Project work/Internship ***Note*:**SDC-1 will be hands-on based skill enhancement course that create expertise in the domain of respective engineering

I Semester (Chemistry Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/MC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0101	Calculus and Differential Equations	FC	3	0	0	3	3	50	50	100	BSC
2	B23AS0104	Engineering Chemistry	FC	3	0	0	3	3	50	50	100	BSC
3	B22AH0103	Communication Skills	FC	0	0	1	1	2	25	25	50	HSMC
4	B22CI0104	Programming with C	HC	3	0	0	3	3	50	50	100	ESC
5	B22ME0103	Elements of Mechanical Engineering	HC	3	0	0	3	3	50	50	100	ESC
6	B22EN0101	IoT and Applications	HC	1	0	1	2	3	50	50	100	ESC
7	B23ME0102	Innovation & Entrepreneurship	FC	1	0	1	2	3	50	50	100	HSMC
8	B22AS0105	Engineering Chemistry Lab	FC	0	0	1	1	2	25	25	50	BSC
9	B22CI0108	Programming with C Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22ME0104	Engineering Workshop	HC	0	0	1	1	2	25	25	50	ESC
TOTAL				**14**	**0**	**6**	**20**	**26**	**400**	**400**	**800**	
TOTAL SEMESTER CREDITS				**20**								
TOTAL CUMULATIVE CREDITS				**20**								
TOTAL CONTACT HOURS				**26**								
TOTAL MARKS				**800**								

II Semester (Physics Cycle)

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE/MC/SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0201	Integral Transforms	FC	3	0	0	3	3	50	50	100	BSC
2	B23AS0202	Engineering Physics	FC	3	0	0	3	3	50	50	100	BSC
3	B22EN0102	Introduction to Accounting	FC	1	0	0	1	1	25	25	50	HSMC

4	B23CS0104	Introduction to Data Science	HC	2	0	0	2	2	50	50	100	ESC
5	B22EE0101	Basics of Electrical and Electronics Engineering	HC	3	0	0	3	3	50	50	100	ESC
6	B22ED0101	Elements of Civil Engineering and Mechanics	HC	3	0	0	3	3	50	50	100	ESC
7	B22ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4	50	50	100	ESC
8	B23AS0207	Engineering Physics Lab	FC	0	0	1	1	2	25	25	50	BSC
9	B23CS0108	Data Science Lab	HC	0	0	1	1	2	25	25	50	ESC
10	B22EE0102	Basics of Electrical and Electronics Lab	HC	0	0	1	1	2	25	25	50	ESC
11	B22EN0201	Skill Development Course-1	SDC	0	0	2	2	4	50	50	100	SDC
12	B22AS0208	Tree Plantation in Tropical Region: Benefits and Strategic Planning	FC	1	0	0	1	1	25	25	50	HSMC
TOTAL				**18**	**0**	**6**	**24**	**30**	**475**	**475**	**950**	
TOTAL SEMESTER CREDITS				**24**								
TOTAL CUMULATIVE CREDITS				**44**								
TOTAL CONTACT HOURS				**30**								
TOTAL MARKS				**950**								

III Semester

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B23AS0305	Linear Algebra and Partial Differential Equations	FC	3	0	0	3	3	50	50	100	BSC
2	B22EN0301	Analog Electronics	HC	3	0	0	3	3	50	50	100	PCC
3	B23EN0302	Digital Electronics	HC	3	0	0	3	3	50	50	100	PCC

4	B22EN0303	Network Analysis and Synthesis	HC	3	0	0	3	3	50	50	100	PCC
5	B23EN0304	Object-Oriented Programming Using C++	HC	3	0	1	4	5	50	50	100	ESC
6	B22EN0305	Analog Electronics lab	HC	0	0	1	1	2	25	25	50	PCC
7	B23EN0306	Digital Electronics lab	HC	0	0	1	1	2	25	25	50	PCC
8	B22EN0307	Course Based Project on Analog and Digital Electronics	HC	0	0	1	1	2	25	25	50	PCC
9	B22EE0310	Universal Human Values	FC	2	0	0	2	2	50	50	100	HSMC
10	B22EN0308	Technical Documentation	FC	1	0	0	1	1	25	25	50	HSMC
11	B22MEM301	Indian Constitution	MC	2	0	0	0	2	00	50	50	HSMC
12	B22EN0309	Skill Development -2	SDC	0	0	2	2	4	50	50	100	SDC
			TOTAL	**20**	**0**	**6**	**24**	**32**	**475**	**475**	**950**	
								TOTAL SEMESTER CREDITS		**24**		
								TOTAL CUMULATIVE CREDITS		**68**		
								TOTAL CONTACT HOURS		**32**		
								TOTAL MARKS		**950**		

IV Semester

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B23AS0402	Probability and Random Process	FC	3	0	0	3	3	50	50	100	BSC
2	B22EN0401	Linear Integrated Circuits	HC	3	0	0	3	3	50	50	100	PCC
3	B22EN0402	Analog Communication	HC	3	0	0	3	3	50	50	100	PCC

4	B22EN0403	Electromagnetics and Transmission lines	HC	2	1	0	3	4	50	50	100	PCC
5	B22EN0404	Signals and Systems	HC	3	0	1	4	5	50	50	100	PCC
6	B22ENS4XX	Professional Elective-1	**SC**	**3**	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**PEC**
7	B22EN0405	Linear Integrated Circuits Lab	HC	0	0	1	1	2	25	25	50	PCC
8	B22EN0406	Analog Communication Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B22EN0407	Course Based project on Linear Integrated Circuits	HC	0	0	1	1	2	25	25	50	PROJ
10	B22CS0301	Professional Ethics	FC	2	0	0	2	2	50	50	100	HSMC
11	B24CI0309	Introduction to Design Thinking	FC	0	0	1	1	2	25	25	50	HSMC
12	B22AS0403	Environmental Science	MC	2	0	0	0	2	00	50	50	HSMC
		TOTAL		**21**	**1**	**5**	**25**	**33**	475	475	950	
								TOTAL SEMESTER CREDITS		**25**		
								TOTAL CUMULATIVE CREDITS		**93**		
								TOTAL CONTACT HOURS		**32**		
								TOTAL MARKS		**950**		

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B22EN0501	Digital Communication	HC	3	0	0	3	3	50	50	100	PCC
2	B22EN0502	Microcontroller and Applications	HC	3	0	0	3	3	50	50	100	PCC
3	B22EN0504	Verilog for FPGA Development	HC	1	1	0	2	3	50	50	100	PCC
4	B22ENS5XX	Professional Elective-2	SC	3	0	0	3	3	50	50	100	PEC

5	B22ENS5XX	Professional Elective-3	SC	3	0	0	3	3	50	50	100	PEC
6	B22XXO5XX	Open Elective-1	OE	3	0	0	3	3	50	50	100	OE
7	B22EN0505	Digital Communication Lab	FC	0	0	1	1	2	25	25	50	PCC
8	B22EN0506	Verilog and FPGA Development Lab	HC	0	0	1	1	2	25	25	50	PCC
9	B22EN0507	Microcontroller and application lab	HC	0	0	1	1	2	25	25	50	PCC
10	B22EN0508	Course Based Project on Microcontroller and applications	HC	0	0	1	1	2	25	25	50	PROJ
11	B22EN0509	Research Based Project	HC	0	0	1	1	2	25	25	50	PROJ
12	B22ED0501	Indian Heritage and Culture (MC)	MC	2	0	0	0	2	25	25	50	HSMC
			TOTAL	**18**	**1**	**5**	**22**	**30**	450	450	900	
TOTAL SEMESTER CREDITS				**22**								
TOTAL CUMULATIVE CREDITS				**115**								
TOTAL CONTACT HOURS				**30**								
TOTAL MARKS				**900**								

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B22EN0601	Microwave and Antennas	HC	3	0	0	3	3	50	50	100	PCC
2	B22EN0602	Digital Signal Processing	HC	3	0	0	3	3	50	50	100	PCC
3	B22EN0603	CMOS VLSI Circuits	HC	3	0	0	3	3	50	50	100	PCC
4	B22EN0503	Control Engineering	HC	3	0	1	4	5	50	50	100	PCC
5	B22ENS6XX	Professional Elective-4	SC	3	0	0	3	3	50	50	100	PEC

6	B22XXO6XX	Open Elective-2 (Multidisplinary)	OE	3	0	0	3	3	50	50	100	OE
7	B22EN0604	Microwave and antennas lab	HC	0	0	1	1	2	25	25	50	PCC
8	B22EN0605	Digital Signal Processing lab	HC	0	0	1	1	2	25	25	50	PCC
9	B22EN0606	CMOS VLSI Circuits lab	HC	0	0	1	1	2	25	25	50	PCC
10	B22EN0607	Skill Development Course-3	SDC	0	0	2	2	4	25	25	50	SDC
11	B22EN0608	Mini Project	HC	0	0	2	2	4	25	25	50	PROJ
	TOTAL			**18**	**0**	**8**	**26**	**34**	425	425	850	-
								TOTAL SEMESTER CREDITS		**26**		
								TOTAL CUMULATIVE CREDITS		**141**		
								TOTAL CONTACT HOURS		**35**		
								TOTAL MARKS		**850**		

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			Course category (As per AICTE)
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B22XXO7XX	Open Elective-3	OE	3	0	0	3	3	50	50	100	OE
2	B22XXO7XX	Open Elective -4(MOOC)	OE	3	0	0	3	3	50	50	100	OE
3	B22EN0603	Computer Networks	HC	3	0	1	4	5	50	50	100	PCC
4	B22ENS7XX	Professional Elective-5	SC	3	0	0	3	3	50	50	100	PEC
5	B22EN0702	Major Project Phase – 1	HC	0	0	2	2	4	25	25	50	PROJ
6	B22EN0704	Skill Development Course(MOOC)/Internship	SDC	0	0	2	2	4	25	25	50	SDC
		TOTAL		**12**	**0**	**5**	**17**	**22**	275	275	550	
								TOTAL SEMESTER CREDITS		**17**		
								TOTAL CUMULATIVE CREDITS		**158**		
								TOTAL CONTACT HOURS		**22**		
								TOTAL MARKS		**550**		

VIII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE/MC	Credit Pattern & Credit Value				Contact Hours/ Week	Examination			
				L	T	P	Total		CIE Marks	SEE Marks	Total Marks	
1	B22EN0801	Major Project Phase – 2	HC	0	0	10	10	20	50	50	100	PROJ
		TOTAL		**0**	**0**	**10**	**10**	**20**	50	50	100	
			TOTAL SEMESTER CREDITS					**10**				
			TOTAL CUMULATIVE CREDITS					**168**				
			TOTAL CONTACT HOURS					**20**				
			TOTAL MARKS					**100**				

	PROFESSIONAL ELECTIVES					
PE	Course Code	Course Name	Course Code	Course Name	Course Code	Course Name
PE-1 / 4TH SEM	B22ENS411	Industrial Electronics	B23ENS412	Python Programming and Applications	B22ENS413	Computer Organization and Architecture
PE-2 / 5TH SEM	B22ENS521	Automotive Embedded System	B22ENS522	Information Theory and Coding	B22ENS523	Theory of Algorithms
PE-3 / 5TH SEM	B22ENS531	Semiconductor Fabrication Technology	B22ENS532	Photonics and Optical Networks	B22ENS533	Object-Oriented Programming in C++ with Data Structures
PE-4/ 6TH SEM	B22ENS641	VLSI design and verification	B22ENS642	Cryptography and Network Security	B22ENS643	Data Base Management Systems
PE-5 / 7TH SEM	B22ENS751	AI and Applications	B22ENS752	Wireless and Multimedia Communication	B22ENS753	Adaptive Signal Processing

OPEN ELECTIVES OFFERED FROM SCHOOL OF ECE							
5TH SEM /OE1		**6TH SEM /OE2**		**7TH SEM /OE3**		**7TH SEM /OE4**	
Course code	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**
B22ECO501	Consumer Electronics	B22ECO601	Basics of Communication Systems	B22ECO701	Automotive Electronics	B22ECOM1	MOOC course
B22ECO502	Embedded Systems	B22ECO602	Sensors and Instrumentation	B22ECO702	Robotic Systems	B22ECOM1	MOOC Course
				B22ECO703	Healthcare Electronics		

First year

(2023-27 Batch)

Detailed Syllabus
Semester-1

Course Title	Calculus and Differential Equations				Course Type		FC	
Course Code	B23AS0101	Credits	3		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number ofClasses Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This is a fundamental course of applied Mathematics which is useful in understanding the concepts of Electronics and electrical communication engineering students. This course begins with understanding concepts of calculus like Taylorsand McLaurin's series. Further it covers reduction formulae which are useful in evaluating standard integrals. Further itenables students to understand and solve linear differential equations.

COURSE OBJECTIVE:

This course enables Engineering students to identify the requirement of applied Mathematics and their applications.

COURSE OUTCOMES: (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of differential calculus in the field of wave theory and communication systems.	1, 2,4	1
CO2	Use Partial differentiation to solve problems in Electronics Engineering.	1, 2,4	1
CO3	Calculate rate of change of multivariate functions using partial differential equations and solve problems related to composite functions and Jacobian.	1, 2,4	1
CO4	Apply multiple integrals to determine area, volume, etc.	1, 2,4	1
CO5	Apply the linear differential equations in modeling.	1, 2,4	1
CO6	Apply analytical techniques to compute solutions and solve differential equations	1, 2,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			✔			
CO2				✔		
CO3						

CO4				✔		
CO5			✔			
CO6			✔			

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1									1		
CO2	3	3		1									1		
CO3	3	3		1									1		
CO4	3	3		1									1		
CO5	3	3		1									1		
CO6	3	2		1									1		

Note: 1-Low, 2-medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT - 1
Calculus-I Successive differentiation- nth derivatives (no proof and simple problems only), Leibnitz Theorem (without proof) and problems. Polar coordinates, Polar curves, angle between radius vector and tangent, angle between two curves. Taylor's series and McLaurin's series expansion for function of one variable (only problems). Applications: Series expansion in Communication signals
UNIT - 2
Calculus-II Partial Differentiation: Partial derivatives-Euler's theorem (only problems), Total derivative and chain rule. Jacobians-definition and problems (only to find J and illustrative example to verify $JJ' = 1$). Taylor's Expansion of function of two variables (only problems- up to 2nd order). Maxima and Minima for a function of two variables (simple problems). Lagrange's multiplier method.
UNIT - 3
Calculus-III Reduction formulae for the integrals of $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$ and evaluation of these integrals with standard limits **(no proof)** - Problems. Multiple Integrals – Double integrals, change of order of integration (simple problems), and triple integrals. Beta and Gamma functions, properties, Relation between beta and gamma functions and simple problems.

UNIT - 4
Differential equations Differential equations of first order: Exact equations. (Reducible to exact not included) Linear Differential Equations: Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral. Method of variation of parameters (simple problems). Cauchy's and Legendre's linear differential equations. Nonlinear differential equations: Solvable for p only, Clairaut's equations. Applications related to RL, RC and LCR circuits.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

JOURNALS:

1. https://www.ajol.info/index.php/jorind/cart/view/50976/39662
2. https://www.academia.edu/Documents/in/Multivariable_Calculus

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/104/111104085/
2. https://nptel.ac.in/courses/111/107/111107108/
3. https://nptel.ac.in/courses/111/107/111107108/

LIST OF EXPERIMENTS USING MATLAB

EXP. NO.	LIST OF EXPERIMENT
1	2D plots for Cartesian and polar curves .
2	Taylors and Maclaurin's series of a function of one variable.
3	Finding partial derivatives and Jacobian and verity Euler' theorem.
4	Taylors and Maclaurin's series of a function of two or more variables. Plot the original expression f and its approximations and how the accuracy of the approximation depends on the truncation order.
5	Program to compute area, surface area, and volume
6	Evaluation of Gamma and beta functions.
7	Finding gradient, divergent, curl and their geometrical interpretation.
8	Applications to Maxima and Minima of two variables .
9	Solution of first order differential equation and plotting the graphs
10	Solutions of Second order ordinary differential equations with initial/ boundary conditions

Course Title	**Engineering Chemistry**				**Course Type**		**FC**	
Course Code	B23AS0104	Credits	3		Class		**I Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				

	Practical	-	-	-	Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Engineering chemistry covers very relevant topics compatible with ECE students and make them aware of importance of various aspects of basic science in engineering. The subject of Engineering chemistry covers area of light and matter interaction, clean energy storage and conversion devices, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the energy conversion and storage devices, which have become very attractive field of research in engineering stream. The subject deals with various engineering materials, their properties and applications in the field of engineering.

COURSE OBJECTIVE (S):

The Engineering chemistry course is designed to fulfil the following objective;

It provide the basic knowledge on Interaction of light and matter to know the electronic transitions in materials and storage and conversion devices.
Corrosion and metal finishing, explains the phenomenon of corrosion and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB
Polymers are all about the properties of various polymeric materials and their Commercial significance. The chapter reveals about technical and commercial Importance of composite materials.

COURSE OUTCOMES (COs):

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the phenomenon of light and matter interaction to study the materials	1**,2,3**	1
CO2	Demonstrate the electrochemical processes & illustrate the method of preparation of solar grade silicon.	1**,2,3,7**	1
CO3	Select different materials in controlling the corrosion & fabrication of printed circuit boards (PCB).	1**,2,3,7**	1
CO4	Illustrate the properties of polymers, nano materials, composite materials and their applications in various fields.	1**,2,3**	1
CO5	Know the doping in photovoltaic devices & applications of Jablonski energy diagram.	1**,2,3,6**	1
CO6	Use of promising materials for electrochemical energy storage and engineering, and environmental remedies.	1**,2,3,7**	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		√				
CO2		√		√		
CO3		√				

CO4		√				
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	**3**	**2**	**1**										**1**		
CO2	**2**	**1**	**1**				1						**1**		
CO3	**1**	**2**	**1**				1						**1**		
CO4	**3**	**2**	**1**										**1**		
CO5	2	2	1			1							**1**		
CO6	3	2	1				1						**1**		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT - 1
Light and Matter Interaction Electro-magnetic spectrum-Applications in Engineering, Interaction of EM radiation with matter, work function of matter, Electrons in matter. Bonding theories: MOT, Band structure of matters HOMO-LUMO. Photochemical and thermal reactions: Laws of photochemistry, quantum yield, high and low quantum yield reactions. Jablonski diagram – photo physical and photochemical processes, photo-sensitization, photo- polymerization and commercial application of photochemistry.
UNIT - 2
Clean Energy Storage and Conversion Devices Introduction to electrochemistry, basic concepts of Batteries and characteristics. Classification: Primary (Dry cell, Li-MnO_2) and Secondary (Pb-acid, Li-ion) batteries. Super capacitors: classification, construction and applications in hybrid **vehicles**. Fuel cells: Alkaline fuel cells, Solid oxide fuel cells and phosphoric acid fuel cell. Photo-conversion devices: Photovoltaic cell and antireflective coating. Production of single crystal semiconductor by Crystal pulling technique (Czochralski technique), difference between single and polycrystalline materials, zone refining process of Si.
UNIT - 3
Concepts of Corrosion Thermodynamics and Kinetics of electrochemical corrosion – Theory for corrosion, galvanic series, thermodynamics aspects of corrosion reactions, Nernst equation, dry and wet corrosion and the cell formation, potential- pH diagram (Fe and Al), kinetics of corrosion reactions, Over voltage, polarization, passivity, immunity. Types of corrosion – Galvanic corrosion, pitting, crevice corrosion, and intergranular corrosion. Corrosion control – Cathodic protection (Sacrificial anode and impressed current methods), Anodic protection. Protective coatings – Metal coatings (hot dip: tinning and galvanizing), spray techniques, role of inhibitors. Metal finishing: Introduction, technological importance. Electroplating: Variables of electroplating bath, Electroplating of Gold. Electroless plating: Distinction between electroplating and electroless plating processes. Electroless plating of copper and applications.

UNIT – 4

Chemistry of Engineering Materials

Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in poly acetylene and poly aniline. **Liquid crystals:** Introduction classification and applications in electronic display devices. **Nano materials:** Introduction, classification based on dimensionality, quantum confinement. Size dependent properties- surface area, magnetic properties (GMR phenomenon), and thermal properties. Synthesis, Properties and applications of Fullerenes, CNT and Graphene.

Sensors: Physical and chemical sensors, Biosensors for bio electronic applications.

Text Books:

1. Jain and Jain, "Engineering Chemistry", Dhanapat Rai Publications, 16th Edition, 2015.
2. SS Dara and SS Umare," Engineering Chemistry,"S. Chand Publications, 17th Edition, 2014.
3. R.V. Gadag & Nithyananda Shetty, "Engineering chemistry", Ik International Publishing house, 3rd Edition, 2014.

Reference Books:

1. Fontana. M.G., "Corrosion Engineering", Tata McGraw Hill, 3rd Edition, 2005.
2. Charles P. Poole Jr and Frank J. Owens," Introduction to Nanotechnology", Wiley-Interscience, 1st edition, 2003.
3. V.R. Gowrikar, N.N. Vishwanathan and J. Sreedhar," Polymer chemistry", NEW AGE International Pvt Ltd, 2021.

JOURNALS/MAGAZINES:

https://www.sciencedirect.com/journal/water-science-and-technology

https://iwaponline.com/wst

https://www.scitechnol.com/nanomaterials-molecular-nanotechnology.php

https://www.journals.elsevier.com/journal-of-energy-storage

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/105/105/105105201/
2. https://nptel.ac.in/courses/112/108/112108150/

Course Title	**Communication Skills**				**Course Type**		**FC**	
Course Code	B22AH0103	Credits	1		Class		**I Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	0	0	0				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**28**	**0**	**50%**	**50%**

Course Description: This course is aimed to develop basic communication skills in English in the learners, to prioritize listening and reading skills among learners, to simplify writing skills needed for academic as well as workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

COURSE OBJECTIVE (S):

The Course objectives are to

1. Develop basic communication skills in English.

2. Emphasize the development of speaking skills amongst learners of Engineering and Technology

3. Impart the knowledge about the use of electronic media such as the internet and supplement the learning materials used in the classroom.

4. Inculcate the habit of reading and writing leading to effective and efficient communication.

COURSE OUTCOMES: (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence, and comprehension an communicate with one or many listeners using appropriate communicativ strategies (Speaking Skills).	10	
CO2	Develop the ability to write cohesively, coherently, and flawlessly avoidin grammatical errors, using a wide vocabulary range, organizing their ideas logicall on a topic (Writing skills).	10	
CO3	Make use of reading different genres of texts by adopting various readin strategies (Reading Skills).	10	
CO4	Take part in interviews confidently and develop accurate writing skills.	10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✔	✔				
CO2	✔	✔				
CO3	✔	✔				
CO4	✔	✔				

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										3					
CO2										3					
CO3										3					
CO4										3					

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents

UNIT – 1
Functional English: Language as a Tool of Communication, - Effective Communication-Modes of Communication- Email communication - Giving Instructions.
UNIT – 2
Interpersonal Skills: Traits of good Listener types of Listening-- Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends/relatives, - Process descriptions (general/specific).
UNIT - 3
Multitasking Skills: Types of Speaking- Paralinguistic Features-Types of paragraphs (cause and effect / compare and contrast / narrative / analytical); Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions, PPT).
UNIT – 4
Persuasive Skills: Reading and Interpretation- SQ3R- Making inference from the reading passage; predicting the content of a reading passage, - Different types of Essay Writing, applying for a job; Writing a cover letter with résumé / CV.

Text Books:

1. Thorpe, Edgar and Showick Thorpe" Objective English". Pearson Education, 2013.
2. Dixson, Robert J. "Everyday Dialogues in English". Prentice Hall India Pvt Ltd., 1988.
3. Turton, Nigel D. "ABC of Common Errors" Mac Millan Publishers, 1995.
4. Ashraf Rizvi, "Effective Technical Communication" McGraw-Hill Education (India) Pvt. LTD., New Delhi, 2018.

Reference Books:

1. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013.
2. 2.Raman, Meenakshi and Sangeeta Sharma. Technical Communication. Oxford University Press, 2015.
3. 3.Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.

Course Title	**Programming with C**				**Course Type**		**HC**	
Course Code	B22CI0104	**Credits**	3		**Class**		**I Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	**50%**	**50%**

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.

6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-3	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5	1
CO3	Develop text processing based applications using string operations.	1-3,5	2,3
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2,3
CO5	Use algorithms and technologies in C Programming for suitable application development	1-5	2,3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9	2,3

BLOOM'S LEVEL OF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3										3		
CO2	1	3	2	2	2								3		
CO3	2	2	2		1									3	3
CO4	3	3	3	1	1									3	3
CO5	3	3	3	2	2										
CO6	3	3	3	2	2				3				3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY

Contents
UNIT-1
Algorithm: Definition, Purpose of writing an algorithm, Rules for writing an algorithm, Advantage of writing algorithm and examples. Flowchart: Definition, Notations used to write a flow chart, Advantage and disadvantages of writing the flowchart and examples. Introduction to "C": Introduction to GitHub, Structure of C program with example, C language & its features, C tokens, data types in C, variables, constants, input and output functions
UNIT-2
Operators and Expressions: Unary operator, assignment operator, arithmetic operator, relational operators, logical operators &bitwise operator, conditional operator, increment and decrement operator, special operator. Conditional Statements: if statement, if-else statement, nested if, switch statement. Unconditional Statements: break and continue statement, goto statement, return statement Iterative Statements (loops): while loop, do-while, for loop, differences between while, do-while and for loop.
UNIT-3
Arrays, functions & Strings: one dimensional array, two dimensional array, Linear and binary search and bubble sorting. Functions: Structure of a function, types of functions, parameter passing mechanisms, Command line arguments. Strings: string operations with and without using inbuilt string functions.
UNIT-4
Structures & Union: Derived types- structures- declaration, definition and initialization of structures, accessing structures, neste structures, arrays of structures, union, typedef. Pointers: Introduction to pointers. File Operations: Formatted Input & Output, Character Input and Output Functions, Direct Input and Output Functions, File Positioning Functions, Error Functions

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4th edition, TATA McGraw Hill, 2000.
4. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A
5. Holistic Approach", second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker," Computer Graphics C Version", second edition, Pearson Education, 2004.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294 (IEEE Journal/Magazine on IT Professional)
2. https://ieeexplore.ieee.org/document/1267572 (IEEE Computing in Science and Engineering)

SWAYAM/NPTEL/MOOCs:

1. https://online courses.nptel.ac.in/noc20_cs06/preview (Problem Solving through Programming in C)
2. https://www.edx.org/course/c-programming-getting-started (C Programming Getting started)
3. https://www.coursera.org/specializations/c-programming (Introduction to C programming)

SELF-LEARNINGEXERCISES

1. **Fundamentals of computer graphics**: output primitives–Line, Circle and Ellipse drawing algorithms- Attributes of output primitives.
2. **Inline Assembly Language Program:** Simple inline assembly, Extended Assembly Syntax Microsoft C Compiler.

Course Title	Elements of Mechanical Engineering				Course Type		HC	
Course Code	B22ME0103	Credits	3		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW

Elements of Mechanical Engineering is a basic course of Mechanical Engineering discipline. It focuses on overall view of mechanical engineering area's like thermal, design and manufacturing streams. The course is designed to understand basic concept like formation of steam and compute the steam properties like specific volume, enthalpy, and internal energy using steam tables. The students are introduced to internal combustion engines, turbines (water, steam and gas) and refrigeration-air conditioning system. The students will be imparted to calculate BP, IP, mechanical efficiency of IC engines. The students are exposed to the machine elements like springs, belt drives and gear drives. Acquainted with different machine tools like lathe, drilling machines and CNC machines. The students will be exposed to joining processes like Soldering, Brazing and Welding and various power transmission systems. Students are introduced to the engineering materials and modern manufacturing Technology like 3D printing technology.

COURSE OBJECTIVES

The objectives of this course are to

1. Develop the basic knowledge on heat & work, steam formation, working principle of boilers, turbines, IC engines and refrigeration - air conditioning systems.
2. Incorporate the concept of different types of machine elements like springs, belt drives & chain drives.
3. Give exposure in the field of engineering materials and manufacturing processes.
4. Incorporate the concepts of modern manufacturing processes like CNC, 3D printing technology and its applications
5. Acquire a basic understanding role of Mechanical Engineering in the industry and society.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO	Course Outcomes	POs	PSOs
CO1	Evaluate the properties of steam and performance parameters of IC engines.	1, 2	1,2
CO2	Describe the working principle of boilers, turbines, refrigeration and air conditioning systems	1	1
CO3	Classify the engineering materials and discuss the concept of casting, CNC machine, laser engraving and 3D printing technology.	1	1
CO4	Compare the different kinds of machine tools and select the suitable machine tool for processing the materials and different metal joining process for the different applications	1,2	1,2

CO5	Discuss the application of machine elements and Calculate the speed ratio of belt drives and Gear Drives.	1,2	1,2
CO6	Describe the need of mechatronics approach in industry and application of robots.	1	1

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											**1**		
CO2	2												1		
CO3	2												1		
CO4	3	1											1	1	
CO5	3	1											1	1	
CO6	1												1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT-1
Introduction to Energy Systems: Concept of heat and work, Steam formation, Types of steam, Steam properties, numerical on steam properties, Introduction to boilers, working of Babcock and Wilcox boiler.
UNIT-2
Prime Movers: Types and working principle of turbines, IC Engines, numerical on IC engines. **Introduction to Refrigeration and Air Conditioning:** Working principle of refrigeration system, working of domestic refrigerator and window air conditioner
UNIT-3
Materials and Manufacturing Processes: Introduction to engineering materials and classifications, casting, Machine Tools-lathe & drilling machine, metal joining process-welding, brazing and soldering, modern manufacturing technology-CNC machines, laser engraving and 3D printing.
UNIT-4
Machine Elements: Types and applications of springs, belt drives, gear drives and chain drives, numerical on belt drives and gear trains. **Introduction to Mechatronics and Robotics:** Need of Mechatronics in industries, measurement system, open and closed loop control system, Robot anatomy, applications of Robotics.

TEXT BOOKS

1. K R Gopala Krishna, Sudheer Gopala Krishna and S C Sharma, “Elements of Mechanical Engineering”, Subhash Publishers, 13th Edition, 2015.

2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, 2000.

REFERENCE BOOKS

1. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, "The Elements of Workshop Technology - Vol I & II", Media Promotors and publisher, 11th edition, 2001.

2. William Bolton, "Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering", Pearson, 2015.
3. K. K. Appukuttan, "Introduction to Mechatronics", Oxford University Press, 2007.

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture

2. International Journal of Refrigeration.

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering

2. https://www.my-mooc.com/en/categorie/mechanical-engineering

3. https://nptel.ac.in/cours

Course Title	**IoT and Applications**				**Course Type**		**HC Integrated**	
Course Code	**B22EN0101**	**Credits**	**2**		**Class**		**I Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-				
	Practical	1	2	2	Theory	Practical	CIE	SEE
	Total	**2**	**3**	**3**	**14**	**28**	**50%**	**50%**

COURSE OVERVIEW:

The Internet of Things (IoT) expands access to the world-wide web from computers, smart phones, and other typical devices to create a vast network of appliances, toys, apparel, and other goods that are capable of connecting to the Internet. This introductory course focuses on IoT architecture, its domains and communication protocols. The course is supported with hands on sessions that incorporates different types sensors interfaced with IoT board to build IoT projects to solve real time problems. The case study of deployment of IoT in various applications are provided.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the architecture of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interface of various sensors to IoT Boards.
4. Discuss the various applications of IoT.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Describe the component of IoT architecture	1,2,3,4,5	1,2
CO2	Interpret various Applications of IoT	1,2,3,4,5	1,2
CO3	Identify IoT development boards, sensors & actuator	1,2,3,4,5	1,2

CO4	Identify communication technologies, protocols, and cloud services	1,2,3,4,5,9,10	1,2
CO5	Demonstrate the interfacing of sensors & actuators to IoT board	1,2,3,4,5,9,10	1,2
CO6	Develop simple IoT projects and modules	1,2,3,4,5,9,10	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√			

COURSE ARTICULATION MATRIX

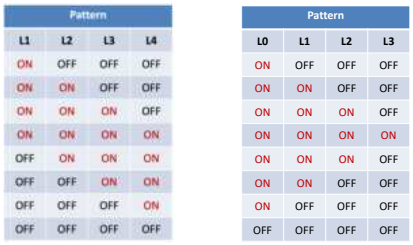
CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1								3	3	
CO2	2	3	1	1	1								3	3	
CO3	3	2	1	1	3								2	2	
CO4	3	2	1	1	3				2	2		2	1	1	
CO5	3	1	2	1	2				2	2		2	2	1	
CO6	3	2	2	1	2				2	2	2	2	1	1	

Note: 1-Low, 2-Medium, 3-High

Course Content Theory:

Contents
UNIT – 1 **IoT Basics** *Previous technologies before IoT, Introduction to IoT, How IoT works, Components of IoT Infrastructure, Basic elements of general IoT Architecture, Characteristics of IoT, benefits and challenges of IoT, Applications of IoT.*
UNIT – 2 *IoT Enabling Technologies* *IoT Development Boards: Arduino, Add-on ESP module, Node MCU, Raspberry Pi; Sensors and Actuators: Temperature Sensor, PIR Sensor, Ultrasonic senor; Communication Technologies: Bluetooth, ZigBee, LoRa, WiFi, Cellular; Protocols: HTTP, MQTT, CoAP; IoT Cloud Platforms: Arduino Cloud, Thing Speak, Blink Cloud*

PRACTICE:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
	Introduction to Arduino Board & getting stared with Arduino IDE software	Hardware & software	Identifications of various parts of
1	Write a program to blink an LED a) Infinite number of times with ON & OFF duration of 1 sec b) infinite number of times with ON time duration 2 sec and OFF time duration 0.5 sec c) Only 3 times with ON and OFF duration 2 sec	Arduino UNO, Arduino IDE, LED's	Arduino coding
2	Write a program to blink 4 LED in the given pattern  Pattern L1 L2 L3 L4 ON OFF OFF OFF ON ON OFF OFF ON ON ON OFF ON ON ON ON OFF ON ON ON OFF OFF ON ON OFF OFF OFF ON OFF OFF OFF OFF Pattern L0 L1 L2 L3 ON OFF OFF OFF ON ON OFF OFF ON ON ON OFF ON ON ON ON ON ON ON OFF ON ON OFF OFF ON OFF OFF OFF OFF OFF OFF OFF	Arduino UNO, Arduino IDE, LED's	Arduino coding, Looping structure
3	Write a program to blink an LED with different times and duration using the concept of user defined function	Arduino UNO, Arduino IDE, LED's	Arduino coding, user define
4	Write a program to interface motion sensor and display its status using g LED. If motion is detected it turn on LED otherwise keeps the turn off the LED.	Arduino UNO, Arduino IDE, LED, PIR sensor	Interface PIR sensor
5	a) Write a program to increase and decrease the brightness of LED. b) Write a program to control the brightness of LED using	Arduino UNO, Arduino IDE, LED,	
6	a) Write a program to interface LDR to Arduino board and display the voltage across LDR on serial monitor b) Write a program to control the brightness of LED based on the intensity of light on LDR	Arduino UNO, Arduino IDE, LED, LDR	Interface LDR sensor
7	a) Write a program to interface temperature sensor and display the values on the serial monitor b) Write a program display range of temperature on LCD	Arduino UNO, Arduino IDE, LCD, Temperature sensor	Interface Temperature sensor
8	Write a program to interface ultrasonic sensor and display the distance from an object.	Arduino UNO, Arduino IDE, Ultrasonic sensor	Interface Ultrasonic sensor
	Challenging Experiments		
9	a) Introduction to ESP module & programming using Arduino IDE software b) Write a program to demonstrates how to use Wifi module ESP8266-01 to blink LED (with simple LED)	ESP8266 Arduino Uno, LED, Arduino IDE	Interface of LED to ESP Module, Program ESP using Arduino IDE
10	Write a program to demonstrate how ESP8266 can be used as an HTTP client and HTTP server to control and monitor the status of an LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server Model

11	Write a program demonstrate how ESP8266 can be used as HTTP Webserver and get commands from the client (mobile/Laptop) directly.	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Client Server model, Create Webserver
12	Write a program to demonstrate how to implement Publisher/Subscriber method (MQTT) to control and monitor the ESP8266 GPIO2 LED	ESP8266, Arduino Uno, LED, Arduino IDE	Understand about Publisher/Subscriber Model
13	Write a program to demonstrate how ESP8266 can be used to log sensor data into thinkspeak cloud.	ESP8266, Arduino Uno, LED, Arduino IDE, ThingSpeak Cloud Service	Connect to cloud and storing data.

Part-B (Case Study/ Projects - Sample Topics)

1. *IoT based Automated Table Lamp*
2. *IoT based Light Dimmer and Speed Controller*
3. *IoT based Energy Monitor and Over Current Cut-off*
4. *IoT based Smart Home Controller Using Blynk*
5. *IoT based Motion Detector Using Cayenne*
6. *IoT based Air Pollution Meter*
7. *IoT based Smart Camera*
8. *IoT based Pet Feeder*
9. *IoT based Electronic Door Opener*
10. *IoT based Underground Cable Fault Detector*
11. *IoT based Air & Sound Pollution Monitoring System*
12. *IoT based Weather Reporting System*
13. *IoT based Toll Booth Manager System*
14. *IoT based Heart Attack Detection & Heart Rate Monitor*
15. *IoT based Person/Wheelchair Fall Detection*
16. *IoT based Water Quality Monitoring System*
17. *IoT based Patient Health Monitoring*
18. *IoT based Garbage Monitoring System*
19. *IoT based Liquid Level Monitoring System*
20. *IoT based Biometric Attendance System*
21. *IoT based Irrigation Monitoring & Controller System*
22. *IoT based Gas Pipe Leakage Detector*
23. *IoT based Alcohol & Health Monitoring System*
24. *IoT based Streetlight Controller System*
25. *IoT based Traffic Signal Monitoring & Controller System*
26. *IoT based Fire Department Alerting System*
27. *IoT based Antenna Positioning System*
28. *IoT based Garbage Monitoring with Weight Sensing*
29. *IoT based Colour Based Product Sorting Machine*
30. *IoT based Smart Mirror with News & Temperature*
31. *IoT based Car Parking System*
32. *IoT based Automatic Vehicle Accident Detection*

TEXTBOOKS:

1. Vijay Madisetti, Arshdeep Bahga , “Internet of Things: A Hands-On- Approach “ Second edition 2014, ISBN: 978 0996025515.

REFERENCE BOOKS:

1. Raj Kamal,” Internet of Things: Architecture & design Principle”, McGraw Hill Education 2017.

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/learn/iot
2. https://www.coursera.org/learn/interface-with-arduino

Course Title	Innovation & Entrepreneurship				Course Type		FC Integrated	
Course Code	B23ME0102	Credits	2		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**2**	**3**	**3**	**14**	**28**	**50%**	**50%**

COURSE OVERVIEW

NEN Ignite is an entrepreneurship program based on experiential learning that aims to support startups' founders through a structured pathway from Idea Discovery to Pitch Deck.

A 14 weeks, 36-42 hours of classroom/digital, highly experiential and practice based entrepreneurship training Course, by Wadhawani Foundation and will be delivered by WF facilitators / NEN Trained Entrepreneurship Faculty.

COURSE OBJECTIVES

The objectives of this course are to:

1. Discover an entrepreneurial opportunity
2. Articulate a compelling value proposition
3. Build a sustainable business model and business plan
4. Create and validate an MVP with potential customers
5. Select an appropriate Go-to-Market Strategy
6. Pitch the business idea to different stakeholders

COURSE OUTCOMES (CO'S)

On successful completion of this course; the student shall be able to:

CO	Course Outcomes	POs	PSOs
CO1	Identify the different aspects that can impact their business	**3,9,10,11,12**	**1**
CO2	Acquire in-depth knowledge about tools to build any business idea	**3,9,10,11,12**	**1**
CO3	Acquire in-depth knowledge about the different growth tools to grow their business.	**3,9,10,11,12**	**1**
CO4	Create a financial plan for their business	**3,9,10,11,12**	**1**
CO5	Create a pitch deck for their business and present it to different stakeholders	**3,9,10,11,12**	**1**

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			**2**						**2**	**2**	**3**	**2**	**2**		
CO2			**2**						**2**	**2**	**3**	**2**	**2**		
CO3			**2**						**2**	**2**	**3**	**2**	**2**		
CO4			**2**						**2**	**2**	**3**	**2**	**2**		
CO5			**2**						**2**	**2**	**3**	**2**	**2**		

Contents:

UNIT -1

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges. Taking product or service ideas to creating value: Why should one choose to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship.

Orientation for WE Ignite program, Ice Breaking session, self-work Instructions and timelines Platform Demo Introduction to Ignite program flow and milestones , Introduction to Entrepreneurship and Human centred Approach to Design Thinking , Are you enterprising?. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving

100 Rupee Venture; Debrief of Group Activity- Presentation and Sharing Learning Experience

Unit - 2

Entrepreneurial Opportunities: Opportunities. Discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering. Problem Identification and Opportunity Discovery.
Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation

Customer and Markets : Customer Discovery: Exploring Customer Personas & Market Estimation for your Ideas, Create a compelling value proposition & Competitive Advantage

UNIT- 3

Build your MVP : Building a MVP that customers Love

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas, Introduction to lean start-ups, Business Pitching

Business Model: Developing strong business models Create and present your Lean Canvas

Financial Feasibility: Introduction to Business plan and its components; Basics of Finance.

Unit 4

Institutional Support for Entrepreneurship:

Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs

Go To market Strategy: Getting products to market: Channels & Strategies; Managing growth and Targeting Scale: Understand the Unit economics for your venture; Funding Strategy: Securing funding for your Startup and Preparing for pitch.

TEXT BOOK:

1.Wadhwani Foundation Curriculum K. Ramachandran, "Entrepreneurship Development", Tata Mc. Graw Hill, 2008

2.Sangeeta Sharma, "Entrepreneurship Development" PHI Publications, 2016

REFERENCE BOOKS:

1.Baringer and Ireland, "Entrepreneurship", Pearson, 11th Edition, 2020.

2.Drucker F Peter: "Innovation and Entrepreneurship", 1985.Heinemann, London.

3.Doanld F Kuratko & Richard M Hodgeth, "Entrepreneurship in the New Millennium", India Edition - South-Western,

4.Cengage Learning Entrepreneurship –by Robert D. Hisrich (Edition-9)

5.Entrepreneurship- Theory, Process & Practice –by Kuratko & Hodgetts, Thompson South-Western Publication

6.Technology Entrepreneurship Taking Innovation to the Marketplace – by Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, Elsevier

JOURNALS/MAGAZINES

1. International Small Business Journal: **https://journals.sagepub.com/home/isb**

2. Journal of Development Entrepreneurship: **https://www.worldscientific.com/worldscinet/jde**

SWAYAM/NPTEL/MOOCs:

1.Entrepreneurship: **https://nptel.ac.in/courses/110/106/110106141/**

Course Title	Engineering Chemistry Lab				Course Type		FC	
Course Code	B22AS0105	Credits	1		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practice	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

Engineering chemistry LAB covers very relevant experiment which is related to the topics compatible with ECE students and make them aware of importance of various aspects of basic science in engineering. The practice gives insights on areas of light and matter interaction, optical properties of materials, clean energy, electrical conduction in solutions, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the importance of science which very essential for research in engineering stream.

COURSE OBJECTIVE (S):

Engineering chemistry lab covers the very basic knowledge and experimental required for engineering students to understand its importance of Science in technology.

1. It provide the basic knowledge and experimental skill on Interaction of light and matter to know the electronic transitions in materials and storage and conversion devices.
2. Corrosion and metal finishing, explains the phenomenon of corrosion and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB.
3. Electrochemical methods will be used to fabricate materials as thin films and various sensing techniques for lab analysis
4. Preparation of semiconducting and conducting materials, polymers and understand their Commercial significance.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Estimate the amount of metal ions present by interaction of light source.	1,2,3,9,10	1
CO2	Demonstrate the electrolytic process in electrochemical cell for the purpose of energy storage and energy conversion devices.	1,2,3,9,10	1
CO3	Describe the corrosion phenomenon and list out various precautions to be taken in the selection of materials in controlling corrosion.	1,2,3,9,10	1
CO4	Preparation of commercially important polymers, Nano materials, composite materials and their applications	1,2,3,9,10	1
CO5	Analyse various water quality parameters in daily life suitable for portability.	1,2,3,8,9,10	1
CO6	Preparation of thin film and bulk solid state conductors and semiconductors relevant to device applications	1,2,3,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√		√		
CO3		√				
CO4		√			√	
CO5		√		√		
CO6		√				

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1						3	3			1		
CO2	2	1	2						3	3			1		
CO3	1	2	1						3	3			1		
CO4	2	2	3						3	3			1		
CO5	2	2	2					3	3	3			1		
CO6	1	2	1						3	3			1		

Note: 1-Low, 2-Medium, 3-High

Practice

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Verification of Beer-Lambert's Law by detection of Copper by spectroscopy.	Calorimeter, Visible spectroscopy, cuvettes	Understand the theory of interaction of light with matter and the electronic transitions in material .Experimentally verify the Beer Lambert law and quantify the amount of substance
2	Estimation of Iron by Potentiometric sensor.	Potentiometer, electrodes, reference electrodes	Understand the theory of potential changes and measure and interpret the potential changes associated with change in chemical composition. This is relevant in electrochemical energy storage and conversion devices like batteries, capacitors, fuel cells
3	Estimation of concentration of acid mixture by Conductometric sensor.	Conductometer, conducting electrolytes	Understand the theory, circuit connection and perform the experiment, Interpret the ionic conductivity in the solution

4	Determination of pH/pKa of solutions using glass membrane electrode sensor.	pH meter, glass electrodes, pH sensing electrochemical cell setup	Understand the electrochemical theory, perform the experiment to sense and evaluate the pH of the give solution. Interpret the importance of pH in engineering materials and their application
5	Faraday's law verification by using Electrodeposition of Cu/Ni/Zn on stainless steel.	DC power supply units, Electrochemical cells, different coating substrate	Understand the theory of soft electrochemical deposition of thin films and perform the experiment on deposition different conductive substrates
6	Determination of percentage of iron in corrosion products.	Ostwald Viscometer	Understand the theory of viscosity and perform the experiment to estimate viscosity of different fluids.
7	Estimation of percentage c Copper in brass alloy b iodometric method	Cu-Zn containing alloy, Iodometric technique	Understand the theory and perform the experiment, collect the data and interpret amount of copper present in the given engineering material
8	Evaluation of Dissolved Oxygen by Winkler's method and hence assessment of quality of water.	Indicators, Industrial and domestic effluents	Understand the theory of Winkler's method and the iodometric estimation.
9	Estimation Of Total Hardness Of Water By Complexometric Method Using EDTA	Hard water, Complexing agents	Understand the theory and perform the experiment to understand and interpret water quality. Devise the easy method for removing the hardness causing agent through complexometry
10	Preparation of semiconducting nanomaterials and characterization.	UV-Vis Spectrophotometer	Understand the theory and perform the experiment to estimate the alkalinity of the industry feed water. Understand the need neutral water, adverse effects of alkaline water
11	Determination of band gap of bulk and Semiconducting materials by UV-Visible spectroscopy.	UV-Visible Spectrophotometer	A better understanding the optical band gap of the materials. Able to perform experiment with UV-Vis spectrophotometer and interpret the spectra and relate with the electronic band structure
12	Synthesis of Conducting Polyaniline from aniline by Chemical method.	Simple oxidation method.	A better understanding of conducting polymers and their relevant applications in devices
13	Preparation of Conducting polyaniline thin film by electro polymerization.	C power supply units, electrochemical reduction techniques, different conducting substrate	To demonstrate the soft and simple electrochemical method for preparation of thin conductive films on desired substrates
14	Preparation of Dye – sensitized solar cell.	FTO, Dyes, Electrolytes, I-V measurement unit, Solar simulation setup	To demonstrate the fabrication of lab scale DSSC and understand the function of photoelectrochemical cell

PART_B: Projects

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	Investigation of ionically conducting media	Conductometer, different ionic conductance media	To demonstrate the effect of ionic conductance and understand the importance in electrochemical energy devices

2	pH and Potentiometric sensor	pH meter, Potentiometer	To demonstrate the effect of pH on engineering materials and the potential changes with change in chemical composition
3	Assembly of energy storage devices	Batteries, DC power supply units	To assemble and perform cell voltage and discharge experiments

Text Books

1. V R Gowariker, N V Viswanathan, Jayadev Sreedhar," Polymer Science", Wiley eastern ltd, 4th Edition, 2021.
2. Sudha Rani, S.K. Bashin, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company; 3rd edition, 2012.

Reference Books:

1. J. Mendham, Vogel's "Quantitative Chemical Analysis", 6th Edition, 2009.

Course Title	**Programming with C Lab**				**Course Type**		**HC**	
Course Code	B22CI0108	**Credits**	1		**Class**		**I Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	1	2	2	-	28	**50%**	**50%**

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.
6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-3,9,10	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5,9,10	1
CO3	Develop text processing based applications using string operations.	1-3,5,9,10	2,3
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5,9,10	2,3
CO5	Use algorithms and technologies in C Programming for suitable application development	1-5,9,10	2,3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9,10	2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1				✓		
CO2			✓			
CO3			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3						3	3			3		
CO2	1	3	2	2	2				3	3			3		
CO3	2	2	2		1				3	3				3	3
CO4	3	3	3	1	1				3	3				3	3
CO5	3	3	3	2	2				3	3					
CO6	3	3	3	2	2				3	3			3	3	2

Note:1-Low,2-Medium,3-High

No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**

1	Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a C program using switch statement to design a basic calculator that performs the basic operations such as addition, subtraction, multiplication and division.	Condition statement	Apply switch and if-else
2	People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a C program to find the coefficients of a quadratic equation and compute its roots.	Conditional branching statement	If or if-else or else-if ladder
3	Consider the age of 3 persons in a family, Write a C program to identify the eldest person among three of them.	Condition checking	Apply if-else
4	Consider student's marks in Computer based Test. Write a C Program to display the grade obtained by a student in Computer Test based on range of marks.	Condition checking	Apply if-else, switch
5	In a stock market at the end of the day, summation of all the transactions is done. Write a C program using arrays to a) Display transactions IDs from1 to 'n'. b) Find the sum of 'n' natural numbers	Looping, sum	Apply for loop and arrays
6	In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a C program using 2-dimensional array to check for compatibility of two matrices and perform matrix Multiplication.	Condition checking, matrix operations	Apply if-else, looping and 2-D array
7	Implement a Program to read N integer numbers into a single dimensional array, sort them in ascending order using bubble sort technique and print both the given array and the sorted array with suitable headings.	Sorting	Use 1-D array, looping
8	Suppose students have registered for workshop, and their record is maintained in ascending order based on student ID's. Write a C program to find whether a particular Student has registered for that particular workshop or not using binary search.	Searching	Use 1-D array, looping
9	In a memory game, you first enter a first string and again enter second string, Write a C program to check whether both the strings are same or not.	Comparison, condition	Use string, if
10	Write a C program to define a structure named Student with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth.	Nested structure	Use structure to store the data

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4th edition, TATA McGraw Hill, 2000.

4. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A
5. Holistic Approach", second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker," Computer Graphics C Version", second edition, Pearson Education, 2004.

Course Title	**Engineering Workshop**				Course Type		HC	
Course Code	B22ME0104	Credits	1		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of classes per Semester		Assessment in weightage	
	Lecture	-	-	-				
	tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	**1**	**2**	**2**				
	Total	1	2	2	0	28	50 %	50 %

COURSE OVERVIEW

Workshop practice provides the basic working knowledge of the production and properties of different materials used in the industry. It also explains the use of different tools, equipment's, machinery and techniques of manufacturing, which ultimately facilitate shaping of these materials into various usable forms. Also to provide the basic knowledge on working and function of two wheeler and four wheeler vehicle engine and power transmission system.

COURSE OBJECTIVES

1. To make student familiar with automobile engine terminology and to have visualization of shape, size and working of engine parts.

2. To introduce the use of tools and instrument and their selection for carrying out the fitting, sheet metal work and welding work.

2. To introduce the processes used of convert of raw material in to product.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO	Course Outcomes	POs	PSOs
CO1	Visualise the parts of two wheeler engine and analyse the sequence of parts connected and their functional relationship.	1, 2, 9	1
CO2	Identify and explain the function of the major components of engine and power transmission system of Toyota Innova and Toyota Fortuner cars	1,2,9	1,2
CO3	Prepare the fitting model as per the given engineering drawing by using appropriate fitting tools.	1, 2, 9	1

CO4	Develop the simple sheet metal models as per drawing specification using sheet metal tools.	1,2,3,9	1,2
CO5	Demonstrate the working and application of laser engraving, 3D printing and welding processes.	1, 9	1,2
CO6	Draw the layout of workshop and prepare a technical document about the process to be followed in engineering workshop.	1,10	1

COURSE ARTICULATIONMATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1							2				1		
CO2	2	1							2				1	1	
CO3	2	1							2				1		
CO4	2	1	1						2				1	1	
CO5	2								2				1	1	
CO6	2									3			1		

Note: 1-Low, 2-Medium, 3-High

Part-A

1. Dismantling and assembly of 2-wheeler (2–stroke) engine Parts.

2. Identification of parts of an engine of Toyota Innova and Toyota Fortuner

3. Calculation of speed ratio of belt, chain and gear drives.

4. Study of power train of bicycle, 2-wheeler and 4-wheeler.

5. Demonstration of laser engraving process and 3D printing process.

Part-B

1. Study of fitting tools and preparation of fitting models.

2. Study of sheet metal tools and development of pen stand and funnel

3. Hands on training on welding.

4. Study of power tools.

TEXT BOOKS

1. K.R. Gopalkrishna, “Elements of Mechanical Engineering”, Subhash Publishers, 12th Edition, 2012.
2. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, “The Elements of Workshop Technology - Vol I & II”, Media Promotors and publisher, 11th Edition, 2001.

REFERENCE BOOKS

1. David A. Crolla, “Automotive Engineering-Powertrain, Chassis System and Vehicle Body”, Butterworth-Heinemann is an imprint of Elsevier, 1st Edition, 2009.

2. R.S.Parmar, “Welding Processes and Technology”, Khanna Publishers, New Delhi, 2003.

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture

2. https://www.shutterstock.com/search/disassembled-bike-engine

3. https://pdfcoffee.com/ex5-assembly-and-disassembly-of-ic-engine-parts-pdf-free.html

SWAYAM/NPTEL/MOOCs

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering
2. https://www.my-mooc.com/en/categorie/mechanical-engineering

3. https://nptel.ac.in/cours

Detailed Syllabus
Semester-II

Title	Integral Transforms				Course Type		FC	
Course Code	B23AS0201	Credits	3		Class		II semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course is an essential one for electrical and electronics engineering students. This course covers the concept ofLaplace transforms, Fourier series, Fourier transforms and z- transforms.

COURSE OBJECTIVE

This course enables graduating students to understand applications of the concepts Laplace, Z-Transforms and Fouriertransforms in signal processing, communications, circuit design.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the Laplace transformation from the time domain to the frequency domain, which transforms differential equations into algebraic equations and convolution into multiplication	1, 2,4	1
CO2	Evaluate - transforms of periodic, discontinuous and discrete functions, Fourier series of various type of functions.	1, 2,4	1
CO3	Apply the Fourier transform to boundary value problems	1, 2,4	1
CO4	Analyze the spectral characteristics of signals using Fourier analysis.	1, 2,4	1
CO5	Apply Z-transform to solve problems in the areas like signal processing, control engineering etc.	1, 2,4	1
CO6	Apply - transform techniques to solve Differential equations and difference equations.	1, 2,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			√			
CO2					√	
CO3					√	
CO4			√			
CO5			√			

CO6			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1									1		
CO2	3	3		1									1		
CO3	3	3		1									1		
CO4	3	3		1									1		
CO5	3	3		1									1		
CO6	3	3		1									1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT – 1 Definition, Transforms of elementary functions, properties of Laplace Transforms (without proof) problems. Transforms of periodic functions (only statement and problems), Unit step functions and unit impulse functions. Inverse Laplace transforms- Problems, convolution theorem (without proof) no verification and only evaluation of problems, solution of linear differential equation using Laplace transforms.
UNIT – 2 **Convergence and divergence of infinite series of positive terms** - definition, Periodic functions, Dirichlet's conditions and Fourier series of period functions of period 2π and arbitrary period, half range Fourier series, Complex form of Fourier series and Practical Harmonic analysis. Illustrative examples from engineering field.
UNIT – 3 **Infinite Fourier Transform**-Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, properties of Fourier transforms, Convolution theorem for F-transforms, Parseval's identity for F-transform. Applications of F-transforms to boundary value problems.
UNIT – 4 **Z-transforms** - Definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems (proof), inverse Z-transform, application of Z-transform to solve difference equations.

TEXT BOOKS:

1. Higher Engineering Mathematics by B.V. Raman Publisher: TMH
2. Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley &SonsInc- 8th Edition

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson
2. Mathematical Methods by Potter & Goldberg; Publisher: PHI.

JOURNALS/MAGAZINES

1. https://www.researchgate.net/publication/323218108_A_review_on_applications_of_laplace_tran

sformations_in_various_fields

2. https://www.researchgate.net/journal/1069-5869_Journal_of_Fourier_Analysis_and_Applications

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/106/111106139/
2. https://nptel.ac.in/courses/111/106/111106111/
3. https://nptel.ac.in/courses/111/106/111106111/

LIST OF MATLAB EXPERIMENTS:

EXP. NO.	LIST OF EXPERIMENT
1.	Laplace transform of standard functions, Dirac and Heaviside functions.
2.	Laplace transform of array inputs and symbolic functions
3.	Inverse Laplace transform involving Dirac and Heaviside functions and inverse Laplace transforms as convolution.
4.	Solve Differential Equations Using Laplace Transform
5.	Solve Differential Equations of RLC Circuit Using Laplace Transform
6.	Problems on z-transformation and inverse z-transformation of some standard function
7.	Solve Difference Equations Using Z-Transform
8.	Fourier transform of a functions
9.	Inverse Fourier transform of a functions
10.	Calculate Beam Deflection Using Fourier Transform

Course Title	**Engineering Physics**				**Course Type**		**FC**	
Course Code	**B23AS0202**	**Credits**	**3**		**Class**		**II semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	**3**	**3**	**3**	**42**	**28**	**50%**	**50%**

COURSE OVERVIEW

Engineering Physics is very important and necessary basic subject for all branches of engineering students. It provides the fundamental knowledge of basic principles of Physics which is required for basic foundation in engineering education irrespective of branch. This course introduces the basic concepts of Physics and its applications to Electronics Engineering courses by emphasizing the following concepts: electrical properties, semiconductor physics, dielectrics, and optical properties. This course has basic laws expressions and theories which helps to increase the scientific knowledge to analyze upcoming technologies. The course also consists of real time and numerical examples which makes subject interesting and attractive.

COURSE OBJECTIVES:

This course enables graduating students to

1. Understand the basic concepts and principles of Physics to analyze practical engineering problems and apply its solutions effectively and efficiently.
2. Gain the knowledge of different physical phenomena, electrical/magnetic/optical properties.
3. Understand design issues, practical oriented skills and problem solving challenges.

COURSEOUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the basics of quantum mechanics and apply its principles to learn the phenomenon that occurs at subatomic dimensions.	1,2,4	1,2,3
CO2	Explain the properties of the materials and classify them into various categories	1,2,3,4	1,2,3
CO3	Understand the origin of magnetism and its applications, different kind of dielectric materials and polarization.	1,2	1,2,3
C04	Understand the light matter interaction, carriers generation and recombination, nano-materials and their interesting properties.	1,2	1,2,3
C05	Explain the light matter interaction, carriers generation and recombination in materials.	1,2	1,2,3
C06	Explore the nano-materials properties and its applications	1,2	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
C04	✓	✓	✓			
C05	✓	✓	✓			
C06	✓	✓	✓			

COURSE ARTICULATIONMATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		1									1	1	1
CO2	3	3	2	2									2	2	1

CO3	3	2											1	1	1
C04	3	2											1	1	1
C05	3	2											2	1	1
C06	3	2											1	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT – 1
CONCEPTS LEADING TO QUANTUM MECHANICS: The Black body radiation spectrum, Plank's quantum theory of radiation. Wave-Particle dualism, deBroglie hypothesis, Matter waves, Heisenberg's uncertainty principle, and its applications (nonexistence of electron inside the nucleus). The wave function, properties of wave function and physical significance. Probability density and normalization of the wave function, Schrodinger time independent wave equation, Eigen values and Eigen functions. Applications of Schrödinger wave equation - Particle in one dimensional infinite potential well with numerical examples.
UNIT – 2
ELECTRICAL PROPERTIES OF MATERIALS: Classical free electron theory and failures, Expression for electrical conductivity, Thermal conductivity, Wiedemann-Franz law, concepts of energy levels and energy band formation in solids. Quantum free electron theory-Success, electrons in metals, Fermi-Dirac statistics, Density of energy states (qualitative), metals and insulators, Electron effective mass. variation of resistivity with temperature. Superconductors and properties of superconductors
UNIT – 3
MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS: Magnetism in materials – magnetic field and induction, magnetization, magnetic permeability and susceptibility, types of magnetic materials, microscopic classification of magnetic materials, Ferromagnetism: origin and exchange interaction, saturation magnetization and Curie temperature, Domain Theory. Dielectric materials: Polarization processes, dielectric loss, internal field, Clausius-Mosotti relation, dielectric breakdown, high-k dielectrics.
UNIT – 4
OPTICAL PROPERTIES OF MATERIALS: Classification of optical materials – carrier generation and recombination processes, Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only), photocurrent in a P-N diode – solar cell – photo detectors – LED – Organic LED – Laser diodes, excitons. **NANOELECTRONIC DEVICES:** Introduction, electron density in bulk material, Size dependence of Fermi energy, quantum confinement, quantum structures, Density of states in quantum well, quantum wire and quantum dot structures, Carbon Nano Tubes and their properties

Text Books

1. M.N. Avadhanulu and P.G. Kshirsagar, "A Text book of Engineering Physics", S. Chand & Company Ltd, New Delhi, 10th revised Ed
2. Gaur and Gupta, "Engineering Physics", Dhanpat Rai Publications 2017
3. David j Griffiths, "introduction to quantum mechanics", Cambridge University Press, 4th edition

REFERENCE BOOKS:

1. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Edu Pvt Ltd- New Delhi, 6 th Ed 2006
2. S O Pillai, "Solid State Physics", New Age International Publishers, 8th Ed
3. S M Sze, Physics of Semiconductor devices, Wiley, 2004

Course Title	Introduction to Accounting				Course Type		FC	
Course Code	B22EN0102	Credits	1		Class		II semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	**1**	**1**	**1**	**14**	**-**	**50%**	**50%**

COURSE OVERVIEW

The course introduces the basic framework of accounting to all students to understand accounting concepts and constraints, and help them in preparation of financial records, statements and analysis of the major financial statements.

COURSE OBJECTIVES:

This course enables graduating students to

1. Educate students about the accounting principles and practices.
2. Orient about accounting recording and identification of income, expenses, Assets and Liabilities.
3. Get detailed knowledge of the practice of accounting in different forms of business
4. Gain the ability of using accounting information as a tool in applying solutions for managerial problems, evaluating the financial performance, and interpreting the financial structure.
5. Make students to Apply quantitative skills to analyse and solve business problems and to take advantage of business opportunities.

COURSEOUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Acquire conceptual knowledge of basics of accounting and Identify events that need to be recorded in the accounting records	1,2,4,11	1
CO2	Identify and analyse the reasons for the difference between cash book and pass book balances	1,2,4,11	1
CO3	Equip with the knowledge of accounting process and preparation of final accounts	1,2,4,11	1
C04	Develop the ability to use accounting information to solve a variety of business problems	1,2,4,11	1
C05	Describe, explain, and integrate fundamental concepts underlying accounting and finance management	1,2,4,11	1
C06	Explain the need for the bank reconciliation statement and cash balance.	1,2,4,11	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)

CO1	✓	✓	✓			
CO2	✓	✓	✓			
CO3	✓	✓	✓			
C04	✓	✓	✓			
C05	✓	✓	✓			
C06	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1		1							1		1		
CO2	1	1		1							1		1		
CO3	1	1		1							1		1		
C04	1	1		1							1		1		
C05	1	1		1							1		1		
C06	1	1		1							1		1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT – 1 **INTRODUCTION TO ACCOUNTING & ACCOUNTING PROCESS** Introduction – Meaning and Definition-Objectives of Accounting – Functions of Accounting – Users of Accounting information- Limitations of Accounting – Accounting Principles –Accounting Concepts and Conventions. Meaning – Process of Accounting – Kinds of Accounts – Rules – Transaction Analysis – Journal – Ledger – Balancing of Accounts – Trail Balance Problems, Accounting Concepts: Entity, Money Measurement, Going Concern, Accounting Period, Cost Concept, Dual Aspect, Accounting Mechanism – Single Entry and Double Entry. (Only Theory)
UNIT – 2 **RECORDING OF BUSINESS TRANSACTIONS** - Voucher and Transactions: Origin of Transactions – Source documents and Vouchers, Preparation of vouchers; Accounting equation approach – Meaning and Analysis of transactions using accounting equation; Rules of debit and credit- Capital & Revenue Transactions. The Accounting Process Recording of Transactions: Books of original entry – Journal (Simple problems), types of subsidiary books (i) Cash book – Simple, Cashbook with bank column and Petty cashbook, (ii) Purchases book, Sales book, Purchases returns book, Sale returns book; Ledger: Meaning, Utility, Format; Posting from journal and subsidiary books; Trial Balance- P& L Account and Balance sheet -Bank Reconciliation Statement: Meaning, Need and Preparation, Correct cash balance. (Simple problems)

Reference Books:

1. Tulsian, P.C. "Financial Accounting", 20th Edition, Pearson Education, 2016
2. S.N. Maheshwari, and. S. K. Maheshwari. "Financial Accounting". 5th Edition, Vikas Publishing House, New Delhi, 2012.

3. Dr. Jawaharlal, " Accounting theory and practices", 4th Edition, HPH, 2022.
4. Bhushan Kumar Goyal and HN Tiwari," Financial Accounting", International Book House, 2021

Course Title	Introduction to Data Science				Course Type		HC	
Course Code	B23CS0104	Credits	2		Class		II Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Total	**2**	**2**	**2**	**28**	**-**	**50%**	**50%**

COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: Set Theory, Probability theory, Tools for data science, ML algorithms and demonstration of experiments either by using MS-Excel/Python/R.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Illustrate the use of basic concepts of Data Science in the real-world applications.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real-world applications.	1 to 4, 12	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5,12	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1, 2, 3
CO4	Demonstrate visualization of Data using python libraries	1 to 5, 8 to 10	1,2, 3
CO5	Find modeling Error in Linear Regression.	1 to 5	1, 2, 3
CO6	Use statistical principles to solve mean and standard deviations for given data.	1 to 4, 12	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember(L1)	**Understand(L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			✓			

CO2			✓			
CO3			✓	✓		
CO4			✓	✓	✓	✓
CO5		✓				
CO6			✓			

COURSE ARTICULATIONMATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2								2	3	1	1
CO2	2	3	2	1	2	2						2	3	2	2
CO3	2	3	3	2	2								3	3	3
CO4	3	3	3	2	2			2	2	2			3	3	3
CO5	2	3	2	2	2								3	3	3
CO6	3	3	2	2								2	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY

Contents

UNIT – 1

Introduction to Microsoft Excel:

History and importance of Microsoft Excel, Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Sorting, Filtering, Grouping, Ungrouping and Subtotal. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel. Import XML Data into Excel, How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.

UNIT – 2

Introduction to Data Science:

What is Data Science? Applications of Data Science, Data science life cycle, Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents.

Introduction to SQL: SQL Commands experimental demonstrations-DDL, DML, DCL, TCL, DQL. Import SQL Database Data into Excel.

UNIT – 3

D Data Relationship Methods:

Introduction to Correlation, Description of linear regression and Logistic Regression, Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.

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UNIT – 4

Data visualization using scatter plots, charts, graphs, histograms, and maps: Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data.

Introduction to Python: Python basics, Strings, Lists, Tuples, Sets, Dictionaries. Introduction to python libraries - Numpy, Matplotlib, Pandas, Scikit-Learn, Implementation of ML.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics",43rdEdition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", 3rdEdition, McGraw Hill Publications, 2003.
3. "Mastering Data Analysis in Excel" - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company,2004.
5. Joel Grus,"Data science from scratch - First principles with Python" , OâReily, 2015.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", 19th edition, Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253IEEE Magazine on Big data and Analytics

SWAYAMNPTEL/MOOCs

1. Excel Skills for Business: Essentials, Macquarie University (https://www.coursera.org/learn/excel-essentials)
2. SQL for Data Science, University of California, Davis(https://www.coursera.org/learn/sql-for-data-science)
3. Data Science Math Skills, Duke Universityhttps://www.edx.org/course/subject/data-science
4. https://onlinecourses.nptel.ac.in/noc19_cs60/preview

SELF-LEARNINGEXERCISES:

1. Relational database management system.
2. Advanced MS-Excel

Course Title	**Basics of Electrical & Electronics Engineering**				**Course Type**		**HC**	
Course Code	**B22EE0101**	**Credits**	**3**		**Class**		**II Semester**	
	LTP	Credits	Contact	Work	Total Number of		Assessment in	
	Lecture	3	3	3	Classes		Weightage	
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW

Basic Electrical & Electronics Engineering covers basic concepts of electrical engineering and electromagnetism. This course introduces the student to the working AC and DC Machines. It also helps the student to understand the basics in digital electronics by applying the knowledge of logic gates and learning the applications of diodes in rectifiers, filter circuits. Further, it has a self-learning component on BJT's.

COURSE OBJECTIVES

The objectives of this course are to:

1) Explain and to make the students familiar about the basics of Electrical Circuits.
2) Illustrate the basics of magnetic circuits and construction, working principle of DC machines, Transformers.
3) Illustrate the characteristics of Diodes and their applications.
4) Discuss the characteristics and applications of BJT's.
5) To familiarize the students about Number systems.
6) To validate the logical expressions using Boolean algebra.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO-1	Summarize the basics of electrical engineering terminology and the usage.	1-2	1
CO-2	Apply KCL and KVL to Solve Electrical Circuits		
CO-3	Demonstrate the working principle of DC Machines and Transformers and provide applications of DC Machines, Transformers	1-2,4	1
CO-4	Analyze the characteristics of PN junction diode, Zener diode and their application	1-2,4	1
CO-5	Analyze the working principle and characteristics in three configurations of BJT	1-2	1
CO-6	Apply the concept of Number system and Arithmetic operations in digital system	1-2	1

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO-1	3	1											1		
CO-2	3	3		2									1		
CO-3	3	2		2									1		
CO-4	3	3											1		
CO-5	3	2											3		
CO-6	3	2	3										3		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Introduction to Electrical Engineering: Basics of DC Circuits: Ohms law, Kirchhoff's Current Law, Kirchhoff's Voltage law, Numerical examples as applicable. Basics of AC Circuits: Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation, RL, RC and RLC series and parallel circuits, power factor, phasor diagrams, three phase AC –types of three phase connection (star and delta), Comparison between single phase and three phase AC, Numerical examples as applicable.
UNIT – 2
Magnetic Circuits and Electrical Machines: Magnetic Circuits: Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance. Electrical machines: DC

Generator, DC Motors, Transformers - Principle of operation, Construction and EMF equations, types and applications. Induction motor: Concept of RMF, Working principle, types and applications Numerical examples as applicable
Unit-3 **Semiconductor Diodes and Transistors**: Semiconductor Diodes :P-N junction diode, V-I Characteristics, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators, Clipping and clamping circuit, Numerical examples as applicable. Transistors: Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.
Unit-4 **Digital Electronics and Number System:** Introduction, Switching and Logic Levels, Digital Waveform. Number Systems and its conversions: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem. Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions.

TEXT BOOKS

1. Nagrath I.J. and D. P. Kothari, "Basic Electrical and Electronics Engineering", Second Edition Tata McGraw Hill, 2020.
2. Hayt and Kimberly, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., "Basic Electrical Engineering", Second Edition, Tata McGraw Hill, 2019.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
5. D.P. Kothari, I. J. Nagrath, "Basic Electronics", Second Edition, McGraw Hill Education (India) Private Limited, 2017.

REFERENCE BOOKS

1. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.
2. Robert L. Boylestad and Louis Nashelsky, "Introduction to Electricity, Electronics and Electromagnetics" Prentice Hall, 5th edition, 2001

SWAYAM/NPTEL/MOOCS

1. https://nptel.ac.in/courses/108108076
2. **https://nptel.ac.in/courses/108101091**
3. **https://www.udemy.com/course/basic-electrical-engineering-part-1**

Course Title	**Elements of Civil Engineering and Mechanics**				**Course Type**		**HC**	
Course Code	**B22ED0101**	**Credits**	**3**		**Class**		**II Semester**	
	LTP	Credits	Contact	Work	Total Number of		Assessment in	
	Lecture	3	3	3	Classes		Weightage	
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	-	-	-				
	Total	3	3	3	42	-	50%	50%

COURSE OVERVIEW:

This course introduces the students to basic concepts of Engineering Mechanics, which are essential for all Engineers. The course familiarizes students shall be learning about mechanical interaction between bodies. That is, we will learn how different bodies apply forces on one another and how they then balance to keep each other in equilibrium, and forces and types of forces, centroid and moment of inertia Students will learn about basic concept of forces, force systems, beams, trusses, properties of geometric shapes.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. Understand a broad concept of Engineering Mechanics.
2. Enable students to apply fundamentals and basic concepts of rigid body mechanics to solve problems of bodies in rest.
3. Enable the students to apply conditions of static equilibrium to analyze physical system of coplanar forces.
4. Analyze the civil engineering structures namely determinate beams and trusses.
5. Provide an overview of centroid and moment of inertia of plane area
6. Understand the concept of dynamics and fluid mechanics in civil engineering.

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand basics of mechanics related to Particle, Continuum and Rigid body; Forces, Couple & moment of couple.	1,2	2
CO2	Compute the resultant of system of forces in plane and space acting on bodies.	1,2,5	2
CO3	Analyze civil engineering structures using static equilibrium conditions.	1,2,3,4,5	2
CO4	Compute the reactions developed at the supports of beams and member forces of trusses.	1,2,3,4,5	2
CO5	Determine the centroid and moment of inertia of different geometrical shapes.	1,2,3,4,5	2
CO6	Solve the engineering problems using dynamic equilibrium condition.	1,2,3,4,5	2

BLOOM'S LEVEL OF THE COURSE OUTCOME

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	

CO5	✓	✓	✓	✓	✓	
CO6	✓	✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3												1	
CO2	3	3			1									3	
CO3	3	3	1	1	3									3	
CO4	3	3	2	1	3									3	
CO5	3	3	2	1	3									3	
C06	3	3	1	1	3									3	

Note: 1-Low, 2-Medium, 3-High

Contents

Unit-1

Introduction to Civil Engineering: Scope of Civil Engineering. Effect of the infrastructural facilities on socio-economic development of a country.

Introduction to Engineering Mechanics: Basic idealizations; Force and its characteristics, Force System and its classification, Principle of superposition of forces, Principle of transmissibility of forces, Moment of a force, couple, moment of a couple, characteristics of couple, Equivalent force - couple system (theory only). Analysis of Force Systems: Resolution of forces, Composition of forces - Definition of Resultant, Composition of coplanar -concurrent force system, Parallelogram Law of forces.

Unit-2

Analysis of Force system: Composition of coplanar - non- concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar concurrent and non-concurrent force systems.

Equilibrium of Coplanar Forces: Definition of static equilibrium, Conditions of static equilibrium for different coplanar force systems, Concept of Free Body Diagram and Lami's theorem with problems.

Unit-3

Centroid: Introduction to the concept, Centroid of plane figures, Locating the centroid of rectangle, triangle and semicircle using method of integration, Centroid of composite sections; Numerical problems.

Moment of Inertia: Introduction to the concept, polar moment of inertia, Radius of gyration, Perpendicular axis theorem and Parallel axis theorem, Moment of Inertia of rectangle, circle, semi-circle and triangle from method of integration, Moment of inertia of composite areas: Numerical problems.

Unit-4

Analysis of structures: Types of beams, loads, support and problems on beams. Plane trusses: Method of joints with numerical.

Introduction to Dynamics : Introduction to Kinematics and Kinetics, Rectilinear motion: uniform motion, uniformly accelerated motion, motion under gravity, Concept of Dynamic Equilibrium with problems.

Introduction to Fluid Mechanics:

Introduction, method of describing fluid motion, definitions of types of fluid flow, stream line, path line and stream tube.

Text Books:

1. T R Jagadeesh, “Elements of Civil Engineering”, Sapna book house
2. BK Kolhapure, “Elements of Civil Engineering”, Eastern Book Promoters
3. M.N. Shesha Prakash and Ganesh.B. Mogaveer, “Elements of Civil Engineering and Engineering Mechanics”, PHI Learning, 3rd Revised edition.

4. Engineering Mechanics by RS Khurmi, S Chand and Company.
5. Fluid Mechanics by P.N. Modi and R.K. Bansal.

Reference Books:

1. A. Nelson, "Engineering Mechanics-Statics and Dynamics", Tata Mc-Graw Hill Education Private Ltd, New Delhi, 2009
2. S. S. Bhavikatti, "Elements of Civil Engineering", New Age International Publisher, New Delhi, 3rd edition 2009.
3. Hydraulics and Fluid Mechanics Including Hydraulics Machines by Dr. P.N. MODI & S.M. SETH (Author), Standard Book House Since 1960.

<table>
<tr><td>Course Title</td><td colspan="3">Computer Aided Engineering Drawing</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22ME0101</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>28</td><td>28</td><td>50 %</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW

Engineering Graphics or Drawing is known as language of engineers. All phases of engineering process require the conversion of new ideas and design concepts into the basic line language of graphics. There are many areas such as civil, mechanical, electrical, architectural, computer, electronics and industrial applications where knowledge and skills of the drawing play major roles in the design and development of new products or construction. This course emphasizes on orthographic projection of point, line, plane surfaces and solids. It also provides knowledge about representing the object in terms of 3D view and also development of the objects.

COURSE OBJECTIVES

The objectives of this course are to

1. Introduce the concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient.
2. Enable students to learn about the software tool for preparing engineering drawings
3. Teach the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids.
4. Communicate the concepts/ideas through the language of technical drawing and sketching.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO	Course Outcomes	POs	PSOs
CO1	Draw orthographic projection of point, line manually and also by using CAD software.	1,2,5,10	1
CO2	Draw orthographic projection of plane surfaces manually and also by using CAD software.	1,2,5, 10	1

CO	Course Outcomes	POs	PSOs
CO3	Draw orthographic projection of simple solids manually and also by using CAD software.	1,2,5, 10	1
CO4	Draw sectional views of prisms, pyramids, cone and cylinder manually and also by using CAD software.	1,2,5, 10	1
CO5	Draw the development of lateral surfaces of the solids manually and also by using CAD software.	1,2, 3,5,10	1
CO6	Create isometric view of the solids manually and also by using CAD software.	1,2,3,5,10	1

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1			2					3			3		
CO2	3	2			2					3			3		
CO3	3	2			2					3			3		
CO4	3	2			2					3			3		
CO5	3	2	2		2					3			3		
CO6	3	1	2		2					3			3		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
Unit-1 **Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software**. Points, Line and Plane Surface: Orthographic projection of points in first and third Quadrant only. Orthographic projection of straight lines inclined to both horizontal and vertical planes. Orthographic projection of regular plane surfaces when the surface is inclined to both HP and VP.
Unit-2 **Solids**: Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.
Unit-3 **Sections of solids**: Drawing sectional views and true shape of section, Development of Lateral Surfaces of Solids: Parallel line method for prisms and cylinders, Radial line method for pyramids and cones
Unit-4 Isometric Projections: Isometric projections of simple and combined solids.

PRACTICE:

Sl. No	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analysing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	analysing and software skill
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analysing and software skill
6.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
7.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
8.	Draw the projection of cone and cylinder inclined to both HP and VP	Solid Edge Software	Interpretation and software skill
9	Draw the projection of section of solids in simple position	Solid Edge Software	Analysing and Software Skill
10	Develop the lateral surface of prisms and cylinder	Solid Edge Software	Creative and Software Skill
11	Develop the lateral surface of pyramids and cone	Solid Edge Software	Creative and Software Skill
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analysing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analysing and software skill

TEXT BOOKS

1. K S Narayanswamy and Mahesh L, "Engineering Drawing", WILEY Publishers, 1st Edition, 2017.

2. K. R. Gopalakrishna and Dr. M S Reddy, "Engineering Graphics-1", Subhas Publications, 2015.
3. Bhatt N.D., Panchal V.M and Ingle P.R, "Engineering Drawing", Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.

REFERENCE BOOKS

1. Luzadder and Duff, "Fundamental of Engineering Drawing", Printice Hall of India Pvt. Ltd. 11th Edition, 2001.
2. Shah, M.B. and Rana B.C., "Engineering Drawing and Computer Graphics", Pearson Education, 2008.

SWAYAM/NPTEL/MOOCS

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://www.udemy.com/course/ed/

Course Title	Engineering Physics lab				Course Type		FC	
Course Code	B23AS0207	Credits	1		Class		II Semester	
	LTP	Credits	Contact Hours	Workload	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50%**

OURSEDESCRIPTION:

Engineering Physics Lab (EPL) is a preparatory course for the B.Tech. Students to give hands on exposure to electronic components, circuits, measurement techniques, graphs plotting and calculations. This lab course correlates theory and experiment to apply scientific techniques to practical problems. The course orients the students to analyze and understand the experimental data.

COURSE OBJECTIVE(S):

The Course Objectives are to

1. Explain the fundamental physics concepts of various electrical and optical components (Resistors, Capacitors, Inductors, Semiconductors, Diodes, LASER, LCR, OFC).
2. Explain the working mechanism of the above components when embedded in circuits.
3. Demonstrate the different applications of electrical and optical components in real world applications.
4. Discuss and design the functionality of these components for real world applications.

COURSEOUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the physics concepts in understanding the new circuits for real-world applications.	1, 2, 6,8,10	1,2,3
CO2	Apply the physics knowledge in developing the real-world applications based on the various combinations of electrical and optical components.	1,2, 3,6,9,10	2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using graphs and tables.	1,2,3,4,9,10	1, 2, 3
CO4	Design the different circuits for day-to-day usage applications for sensors and other applications.	1,2,3,4,9,10	1, 2, 3
CO5	Illustrate modeling indifferent circuits through software.	1,2,5,10	1, 2, 3
CO6	Demonstrate the different circuits to predict the different outcome.	1,2,3,9,10	1,2, 3

BLOOM'SLEVELOFTHECOURSEOUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	**Understand (L2)**	**Apply(L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1		✓				
CO2			✓			
CO3				✓		
C04			✓	✓	✓	✓
CO5		✓				✓
CO6			✓			✓

COURSE ARTICULATIONMATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3				2		1					3	3	3
CO2	2	2	2			1			3	3				3	3
CO3	3	3	2	2		2			3	3			3	3	3
CO4	3	3	3	2	2				3	3			3	3	3
CO5	3	3			2					3			3	3	3
CO6	3	3	3						3	3			3	3	3

Practice:

No	**Title of the Experiment**	**Tools and Technics**	**Expected Skill/Ability**
1	Determination of Planck's constant using light emitting diode (LED).	LED's of different colors, circuit board and wires	Understand the theory, circuit and perform the experiment, collect the data and interpret the results.
2	Determination of energy gap of a given semiconductor.	Semiconductor, hot water, circuit board and wires.	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to estimate the bandgap
3	Study of Photo Diode characteristics.	Photo diode, light source, circuit board and wires	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to know the photo response of a diode.
4	Study of variation o Resistivity in intrinsic sem conductor crystal	Semiconductor, hot water, thermometer	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to know the temperature dependent response of a semiconductor.
5	Inductor-capacitor-resistance (LCR) Series & Parallel circuits	Inductor, capacitor and resistance connected circuit board, variable function	Understand the theory, circuit connection and perform the experiment, collect the data and

		generator, wires	interpret the results to know the variation of AC resistance of LCR series and parallel connection.
6	Determination of numerical aperture (N.A.) of given optical fiber	Optical fiber cable, light source, graduated circular stand	Understand the theory, connection and perform the experiment, collect the data and interpret the results to know the numerical aperture of a given cable.
7	Diffraction haloes using ligh amplification by stimulate emission of radiation (LASER	LASER light source, lycopodium particle dispersed glass slide, screen	Understand the theory and perform the experiment, collect the data and interpret the results to estimate the particle size.
8	Dielectric constant by charging and discharging of a capacitor	Capacitor, resistance, voltmeter, timer connected circuit board	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to estimate the dielectric constant of a given material.
9	Determination of wavelength of a LASER by diffraction	LASER light source, grating, screen	Understand the theory and perform the experiment, collect the data and interpret the results to estimate the wavelength of a given light source.
10	Attenuationand propagation characteristics of optical fiber cable (OFC)	Optical fiber cable, light source, intensity measuring unit.	Understand the theory and perform the experiment, collect the data and interpret the results to know the intensity of a reduced light.
11	Simulation of rectifier diode/Zener diode characteristics using TINA(in the computer) or Every circuit (in mobile)	Computer, TINA tool.	A better understanding of the working of the diode by forcing different voltages through the tool and seeing the characteristic curves on the monitor.
12	Simulation of LCR series and parallel circuits using TINA(in computer) or Every circuit (in mobile)	Computer, TINA tool.	A better understanding of the working of the LCR circuits by replacing different L, C & R values.

PART_B:Projects

Design projects. Some sample projects are given below:

Sl. No.	**Suggested sample Projects**
1.	**Instruments interface using LabVIEW.**
2.	**Photonics experiments:** **1. brewster's angle experiment** **2. Optical fiber.**

Text Books

1. M.N. Avadhanulu and P.G. Kshirsagar, “A Text book of Engineering Physics”, S. Chand & Company Ltd, New Delhi, 10th revised Ed

2. Gaur and Gupta, “Engineering Physics”, Dhanpat Rai Publications 2017

REFERENCE BOOKS:

1. Arthur Beiser, “Concepts of Modern Physics”, Tata McGraw Hill Edu Pvt Ltd- New Delhi, 6 th Ed 2006

2. S O Pillai, “Solid State Physics”, New Age International Publishers, 8th Ed

3. S M Sze, Physics of Semiconductor devices, Wiley, 2004

Course Title	Data Science Lab				Course Type		HC	
Course Code	B23CS0108	Credits	1		Class		II Semester	
Course Structure	LTP	Credits	Contact Hours	Workload	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50**	**50**

COURSE DESCRIPTION:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: ML algorithms, SQL and demonstration of experiments by using MS-Excel and MySQL and Python .

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Explain the algorithms of Machine learning.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Microsoft Excel in developing the real-world applications.	1 to 5, 8 to 10	1,2,3
CO2	Apply the SQL Queries in developing the real-world applications.	1 to 5, 8 to 10	2, 3
CO3	Build the solutions for real world problems, perform analysis, interpretation and reporting of data using regression algorithms.	1 to 5, 8 to 10	1, 2, 3
C04	Design ER diagrams for database.	1 to 5, 8 to 10	1, 2, 3
CO5	Use Excel to solve Multiple Linear Regression.	1 to 5, 8 to 10	1, 2, 3
CO6	Demonstrate visualization of Data using python libraries	1 to 5, 8 to 10	1,2, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply(L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1			✓			
CO2			✓			
CO3			✓	✓		
C04			✓	✓	✓	✓
CO5		✓				
CO6			✓			

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2			1	3	3			3	3	3
CO2	2	2	2	2	2			1	3	3			3	3	3
CO3	3	3	2	2	2			1	3	3			3	3	3
CO4	3	3	3	2	2			1	3	3			3	3	3
CO5	3	3	3	2	2			1	3	3			3	3	3
CO6	3	3	3	2	2			1	3	3			3	3	3

Practice:

<table>
<tr><th>No</th><th>Title of the Experiment</th><th>Tools and Technics</th><th>Expected Skill/Ability</th></tr>
<tr><td>1</td><td>The height (in cm) of a group of fathers and sons are given below, Findthe lines of regression and estimate the height of son when the height of father is 164 cm.
<table>
<tr><td>Hgt of Father</td><td>158</td><td>166</td><td>163</td><td>165</td><td>167</td><td>170</td><td>167</td><td>172</td><td>177</td><td>181</td></tr>
<tr><td>Hgt of Son</td><td>163</td><td>158</td><td>167</td><td>170</td><td>160</td><td>180</td><td>170</td><td>175</td><td>172</td><td>175</td></tr>
</table></td><td>MS Excel</td><td>Create and perform operations on Excel data set by applying Linear regression</td></tr>
</table>

<table>
<tr>
<td>2</td>
<td>Using the data file DISPOSABLE INCOME AND VEHICLE SALES,perform the following:
i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trend line feature.
iv) Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900.
v) Compute the coefficient of determination and the coefficient of correlation</td>
<td>MS Excel</td>
<td>Perform prediction and visualiza-tion of data</td>
</tr>
<tr>
<td>3</td>
<td>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.

i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trend line feature).
iv) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
v) Compute the coefficient of determination and the coefficient of correlation.</td>
<td>MS Excel</td>
<td>Perform prediction and visualiza tion of data</td>
</tr>
<tr>
<td>4</td>
<td>Apply multiple linear regression to predict the stock index price which is a dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.
<table>
<tr><th>Year</th><th>Month</th><th>Interest rate</th><th>Un employmen t rate</th><th>Stock index price</th></tr>
<tr><td>2022</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr>
</table>
</td>
<td>MS Excel</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>5.</td>
<td>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10,00,000 has been borrowed from a bank with annual interest rate of 5.2% and the customer needs to pay every month as shown in table below. Calculate the total interest rate paid for availed of Rs.10, 00,000during 3 years.
<table>
<tr><th>Sl.no</th><th>A</th><th>B</th></tr>
<tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr>
<tr><td>2</td><td>Annual interest rate</td><td>5.2%</td></tr>
<tr><td>3</td><td>Year of the loan</td><td>3</td></tr>
<tr><td>4</td><td>Starting payment number</td><td>1</td></tr>
<tr><td>5</td><td>Ending payment number</td><td>36</td></tr>
<tr><td>6</td><td>Total interest paid during period</td><td>?</td></tr>
</table>
</td>
<td>MS Excel</td>
<td>Create Excel data and perform EMI estimator</td>
</tr>
</table>

6	Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO should not be NULL.	SQL	Creating Tables
7	Create the customer database of a big Market with CUSTOMER_ ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_ CODE. Store at least twenty customer's details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.	SQL	Creating and retrieving Tables
8	Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.	MS Excel	Apply Linear regression
9	Apply Multiple linear regression to predict the factory products which is A, B and C are independent variables and cost dependent variable.	MS Excel	Apply Linear regression
10	Logistic Regression-case study	MS Excel	Apply Logistic regression
11	Design the ER diagram and create schema of the REVA library Management system.	Entity Relationship	Entity Relationship
12	Perform Exploratory Data Analysis to predict customer churn in telecommunications company using Python libraries such as Pandas, and Matplotlib to aid in this process? (Use datasets from Kaggle/NCBI.)	Jupyter/Colab - Python	Apply Exploratory Data Analysis

PART_B:Projects

No	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	Big Mart sales forecasting	MS Excel	Apply Linearregression
2	Bangalore crime analysis	MS Excel	Apply Linearregression

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", 3rd Edition, McGraw Hill Publications, 2003.
3. "Mastering Data Analysis in Excel" - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company,2004.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", 19th edition, Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013.
3. Seymour Lipschutz, John J. Schiller, "Schaum's Outline of Introduction to Probability and Statistics", McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060 International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253 IEEE Magazine on Big data and Analytics

Course Title	Basics of Electrical & Electronics Lab				Course Type		HC	
Course Code	B22EE0102	Credits	1		Class		II Semester	
	LTP	Credits	Contact	Work	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practice	1	2	2				
	Total	1	2	2	-	28	50%	50%

COURSE OVERVIEW

Basic Electrical & Electronics Engineering lab covers the concept of various types of electrical apparatus, tools and conduction of experiments to Analyze, Design of KCL & KVL, two-way switch or staircase wiring, Determination of VI characteristics Zener Diode, Silicon Diode, Half Wave rectifier using Diode, study& analyses of Lead & lag component, verification of logic gates.

COURSE OBJECTIVES

The objectives of the course are to

1. Establish a broad concept of various types of electrical apparatus, tools and instrumentation.
2. Provide hands on experience with electrical apparatus and electrical safety norms.
3. Train students to read and understand schematics so as to make electrical connection for different appliances.
4. Train students in collecting and interpreting experimental data.
5. Enhance written skills of students.

COURSE OUTCOMES (CO'S)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	PO's	PSO's
CO-1	Use appropriate electrical tools for electrical connections and repair of electrical equipment's.	1,2,4,5,9,10	1
CO-2	Recognize various symbols in a schematic and make connection as per the schematic	1,2,9,10	1
CO-3	List out various safety procedures	4,5,9,10	1
CO-4	Make use of various measuring instruments to collect experimental data	2,4,9,10	1
CO-5	Analyse the results obtained from experiments.	2,3,9,10	1
CO-6	Demonstrate the ability to critically evaluate the performance of electrical appliances.	1,2,9,10	1

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3		3	3				3	3			1		
CO-2	3	3							3	3			1		
CO-3				3	3				3	3			1		
CO-4		3		3					3	3			1		
CO-5		3	2						3	3					
CO-6	3	2							3	3					

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

List Experiment

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	To verify KCL and KVL	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2	Study and Analysis of Lead & Lag networks by using R-C components.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
3	Two-way switch/ staircase wiring. To study & verify the connection procedure for two-way switch or staircase wiring	Two-way switch or staircase wiring Kit	Connection, Working & application of Two-way switch
4	Study and analysis the Characteristics: light sensor and temperature sensor	Sensor kit	Characteristics of sensors
5	Study and analysis of V-I Characteristics of Zener PN Junction diodes (Both Forward and Reverse Characteristics).	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
6	Study and analysis of Transistor as switch	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor of rectifiers
8	Design of Clippers and clampers with reference voltages	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
9	Study and analysis of input output characteristic of CE configuration of BJT.	Characteristics of BJT in Common Emitter Configuration	Input & Output Characteristics of BJT
10	Verification of basic logic gates using discrete components	Trainer kit	Universal gates will be realized using basic gates

Demo:

1. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.
2. To study the Importance and mechanism of MCB.

TEXT BOOKS

1. Nagrath I.J. and D. P. Kothari, “Basic Electrical Engineering”, Third Edition Tata McGraw Hill, 2009.
2. Hayt and Kimberly, “Engineering Circuit Analysis”, 8th Edition, Tata McGraw Hill, 2013.
3. Kulshreshtha D.C., “Basic Electrical Engineering”, Tata McGraw Hill, 2009.
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall, India, 2009.

REFERENCE BOOKS

1. Theodore Wildi, “Electrical Machines, Drives, and Power, 5thSystems”, Pearson Edition, 2007.
2. Hughes, “Electrical Technology”, International Students 9th Edition, Pearson, 2005.

SWAYAM/NPTEL/MOOCs

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091
3. https://www.udemy.com/course/basic-electrical-engineering-part-1

Course Title	**Tree Plantation in Tropical Region: Benefits and Strategic Planning**				**Course Type**		**FC**	
Course Code		**Credits**	**1**		**Class**		**II Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	1	1	1	14	0	50%	50%

Course Description: This course introduces significance of trees that provide us with a great many ecosystem services, including air quality improvement, energy conservation, stormwater interception, and atmospheric carbon dioxide reduction. These benefits must be weighed against the costs of maintaining trees, including planting, pruning, irrigation, administration, pest control, liability, cleanup, and removal.

Students are expected to involve in planting a tree and nurturing till the completion of their degree program. Successful maintenance of tree is considered to be one of the eligibility criterions for the award of university degree.

This course is a part of "**REVA Vanamahotsava – One Student, One Tree"**

COURSE OBJECTIVE (S):

The Course objectives are to

1. Develop basic understanding of role of trees in climate change
2. Emphasize on the selection and placing a tree for maximum benefit to environment
3. Involve in planting a tree and nurture till the completion of the degree program
4. Generate experiential report on the tree plantation process involved

COURSE OUTCOMES: (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Interpret the possible key benefits of trees arresting climate change and global warming	7,9	
CO2	Develop the ability to identify the type of a tree to be planted in urban area agricultural fields and forestry areas	7,9	

CO3	Make use of reading different literature on climate change and global warming by adopting various reading strategies (Reading Skills)	7,9	
CO4	Take part in planting a tree and nurturing it and Generate report on tree plantatio process involved	7,9	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		✓		✓		
CO2		✓	✓	✓		
CO3		✓		✓		
CO4		✓		✓		✓

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							3		3						
CO2							3		3						
CO3							3		3						
CO4							3		3						

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
Unit 1: Introduction: The tropical region, Benefits and costs of urban and community forests
Unit 2: General Guidelines for Selecting and Placing Trees Guidelines for Energy Savings, Guidelines for Reducing Carbon Dioxide, Guidelines for Reducing Stormwater Runoff, Guidelines for Improving Air Quality Benefits, Guidelines for Avoiding Conflicts with Infrastructure, Guidelines for Maximizing Long-Term Benefits, Trees for Hurricane-Prone Areas **Activity based learning** Every student has to thoroughly understand the significance of planting a tree, identify type of tree and place to be planted, plant a tree and nurture till the completion of the degree.

Text Books:

1. Kelaine E. Vargas, E. Gregory McPherson, James R. Simpson, Paula J. Peper, Shelley L. Gardner, and Qingfu Xiao, "Tropical community tree guide: Benefits, Costs and Strategic Planting", U.S. Department of Agriculture, Forest Service Pacific Southwest Research Station Albany, California, 2008

Reference Books:

1. Peter Wohlleben, The Heartbeat of Trees, Penguin Books, 2021
2. Daniel Chamovitz, "What a Plant Knows: A Field Guide to the Senses", 2020

Evaluation of this course

As per 9.27 of the **"Academic Regulations UG -Engg 2022",** following evaluation procedure is applicable to this course.

9.27 Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below (for theory courses having Credit 1).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 8th Week	First 50%	25	12.5	8th week
2	Test -2	During 15th Week	Remaining 50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

Additional guidelines for conducting this course

Since this course is aimed as a special drive to restore climate change and arresting global warming, following guidelines have been framed to conduct this course as activity-based learning to build greener nation through student community. Successful implementation of this drive meets one of the very important Sustainable Development Goals (SDG's) of UN Envision 2030 on Climate Change and Global warming. This is also one of the requirements in NEP 2020 and UGC/AICTE.

1. Classes will be conducted by the nominated faculty (one hour per week) as per the syllabus.
2. Flipped classes, field experiences, group discussions and seminars can be used by the faculty so as to engage the students through student centric learning mechanisms
3. Students should be involved into understanding cause and effects of climate change, types of pollutions, and environmental hazards
4. Quizzes and debates on climate change and global warming can be arranged for each section
5. Students should plant the suitable tree and nurture
6. "Team Vanamahotsava" – A Central assistance team from REVA University will support for identifying trees, place and organizing plantation drives.

7. Regular progress review is planned to be monitored by digital system – an advanced version of current progress monitoring App.
8. School Directors are responsible to oversee all the arrangements and progress monitoring of this drive.
9. Frequent school level and university level branding shall be arranged to give awareness of this noble drive among all the stake holders such as parents, alumni, industry and academic partners, government sectors, NGO's, ministries, and the society.
10. Regular plant maintenance drive can be planned by "Team Vanamahotsava". However, planting a tree and its nurture responsibility solely rests on individual students.
11. Successful maintenance of tree is considered to be one of the eligibility criterions for the award of university degree.

Second Year

(2023-27 Batch)

Detailed Syllabus
Semester III

Course Title	Linear Algebra and Partial differential equations				Course Type		Theory	
Course Code	B23AS0305	Credits	3		Class		III sem	
Course Structure	TLP	Credits	Contact	Work	Total Number of Classes Per Semester		Assessment Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-				
					Theory	Practical	CIE	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW

Linear algebra is the study of linear systems of equations, vector spaces and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in Science and Engineering. The objective of the course is to give introduction to Partial Differential Equations for undergraduate students.

COURSE OBJECTIVE

The objectives of this course are to:

1. Understand the concepts of linear algebra and solving of system of equations Y = AX**.**
2. Understand the concepts of basis, dimension and linear transformation.
3. Understand vector differentiation, div, grad and curl.
4. learn about formation and solving partial differential equations

	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of Linear Algebra in Image processing and digital signal processing.	1,2,3,4	1
CO2	Solve Engineering problems using Rayleigh Power method to find largest Eigen value and Eigen vector.	1,2,3,4	1
CO3	Apply the knowledge of vector spaces in engineering like digital communication.	1,2,3,4	1

C04	Find Surface integral and volume integral of given function to prove Stokes and Divergence theorem	1,2,3,4	1
C05	Apply the knowledge of vector calculus in engineering like field theory.	1,2,3,4	1
C06	Apply the knowledge of PDE in solving heat equation, wave equation and Laplace equation.	1,2,3,4	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
C04	✓	✓	✓	✓		
C05	✓	✓	✓	✓		
C06	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1									1		
CO2	3	2	2	2									1		
CO3	3	3	2	1									1		
CO4	3	2	2	1									1		
CO5	3	3	2	1									1		
CO6	3	3	2	1									1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

CONTENTS

CONTENTS
UNIT - 1: Linear Algebra: Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector. Linear and Inverse transformation. Diagonalisation of a matrix, Reduction of a quadratic form to canonical form by orthogonal transformation. **MATLAB experiments:** Finding the rank of matrix. Solution of system of linear equations. Computation of Eigen values and Eigen vectors of a given matrix.
UNIT – 2: Vector Space: Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank- Nullity theorem (without proof). Matrix form of linear transformations-Illustrative examples. **MATLAB experiments:** Computation of basis and dimension for a vector space and Graphical representation of linear transformation.
UNIT – 3: Vector Calculus: Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields. Vector identities-div ($\emptyset A$), curl ($\emptyset A$), curl (grad$\emptyset$), div (curl *A*). **Line integral**-Circulation-work, Surface integral: Green's Theorem, Stokes Theorem. Volume integral: Divergence theorem. (**All theorems without proof, no verification, only evaluation).** **MATLAB experiments:** Finding gradient, divergent, curl. Evaluation of line integrals. Verification of Green's theorem. Evaluation of volume integral and surface integral.
UNIT - 4: Partial differential equations: Formation of Partial differential equations by eliminating arbitrary constants and arbitrary variables. Equations solvable by direct integration, Solution of Lagrange's linear PDE. Method of variable separable: 1 – D heat equation, 1-D wave equation. Non-linear equations of the first order. Charpit's method. **MATLAB experiments:** Solution of PDEs.

Solution of heat equation.

Text Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.
3. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
4. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.journals.elsevier.com/linear-algebra-and-its-applications/most-downloaded-articles
2. https://www.researchgate.net/publication/304178667_A_Study_on_the_Linear_Algebra_Matrix_in_Mathematics
3. https://www.sciencedirect.com/journal/linear-algebra-and-its-applications/vol/1/issue/1
4. http://vmls-book.stanford.edu/vmls.pdf
5. https://www.researchgate.net/publication/317685719_A_Study_of_General_First-order_Partial_Differential_Equations_Using_Homotopy_Perturbation_Method
6. https://www.journals.elsevier.com/partial-differential-equations-in-applied-mathematics/

SWAYAM/NPTEL/MOOCs:

1. https://www.youtube.com/watch?v=LJ-LoJhbBA4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7
2. https://www.youtube.com/watch?v=9h_Q-R6sXbM&list=PL7oBzLzHZ1wXQvQ938Wg1-soq09GywgOw
3. https://www.youtube.com/watch?v=Kk5SEzASkZU&list=PL9m2Lkh6odgKbfY03TFRhwjOqW79UdzK8
4. https://www.youtube.com/watch?v=W3HXK1Xe4nc&list=PLbPn3CUduj5TPQtrwfI70F1SW4LvPf90d
5. https://www.youtube.com/watch?v=Nonfmx0-LQQ

Course Title	Analog Electronics				Course Type		HC	
Course Code	B22EN0301	Credits	3		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-			Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**		**50%**	**50 %**

COURSE OVERVIEW:

Analog Electronics is an essential area of study for Electronics and Communication Engineering students, as it forms the foundation for many electronic devices and systems used in various industries such as telecommunications, automotive, consumer electronics and medical devices. Analog circuits are used in many applications such as signal processing, amplification, filter, power regulation and control systems. The topics include in this course are design and analysis of BJT and

MOSFET amplifiers ,feedback amplifiers, power amplifies, differential amplifiers and operational amplifiers.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand types of BJT biasing and operation of BJT amplifiers
2. Understand types of MOSFET biasing and operation of MOSFET amplifiers
3. Learn about feedback concepts.
4. Comprehend the operation of differential and operational amplifiers

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design and analyze the single stage BJT amplifiers	1,2,3,4,5,12	1,2,3
CO2	Compare the characteristics of CE , CB and CC amplifiers	1,2,3,4,5,12	1,2,3
CO3	Design and analyze single stage MOSFET amplifiers	1,2,3,4,5,12	1,2,3
CO4	Construct various types of feedbacks in amplifiers and analyze their characteristics.	1,2,3,4,5,12	1,2,3
CO5	List the characteristics of MOS differential pair	1,2,3,4,5,12	1,2,3
CO6	Construct and analyze the different applications of operational amplifiers	1,2,3,4,5,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓			
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓			
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2							1	1	1	
CO2	2	2	2	2	2							1	1	1	
CO3	2	2	2	2	2							1	1	1	1
CO4	2	2	2	2	2							1	1	1	1
CO5	2	2	2	2	2							1	1	1	1
CO6	2	2	2	2	2							1	1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1
BJT BIASING AND SINGLE STAGE AMPLIFIERS: Review of BJT Device Structure and Physical Operation, BJT Current Voltage characteristics, Operating point, BJT biasing and stability, Amplifier Basic Principles, Circuit Models for Amplifiers, Frequency Response of Amplifiers, Small Signal Models for BJT, Analysis of CE, CB, CC Amplifiers.
UNIT – 2
MOSFET BIASING AND SINGLE STAGE AMPLIFIERS :MOSFET Device Structure and Physical Operation, MOSFET Current Voltage characteristics, MOSFETS Circuits at DC, MOSFET Biasing and stability, Small Signal models for MOSFET, Analysis of CG, CS,CD Amplifiers.
UNIT – 3
FEEDBACK AND POWER AMPLIFIERS: **FEEDBACK AMPLIFIERS:** Feedback Concepts, Feedback Connection Types, Practical Feedback Circuits- Voltage Series Feedback and Current-Series Feedback. Related problems. **POWER AMPLIFIERS:** Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier, Class B Amplifier Circuits- Transformer-coupled Push-Pull Circuits, Complementary-symmetry Circuits, Class C and Class D amplifiers. Related Problems
UNIT – 4
DIFFERENTIAL AMPLIFIERS AND OPERATIONAL AMPLIFIERS:MOS Current Mirror, Common Mode Rejection Ratio, DC Offset, MOS Differential Amplifier Op-Amp Introduction, Ideal characteristics, Inverting Amplifier and analysis, Non-Inverting Amplifier and analysis, Summing Amplifier, Difference amplifier Buffer, Integrator, Differentiator

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 11th edition, 2015.
2. David A. Bell, "Electronic Devices & Circuits", Prentice Hall of India/Pearson Education, 4th edition, 2007.
3. David A. Bell, "Operational Amplifiers and Linear ICs", Prentice Hall of India, 2nd edition, 2006.

REFERENCE BOOKS

1. Jacob Millman & Christos. C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits ",Tata McGraw Hill, 2nd edition, 2008.
2. Floyd, "Electronic Devices", Prentice Hall of India, Pearson Education, 6th Edition, 2010. Anil Kumar Maini, Varsha Agrawal,"Electronic Devices and Circuits", John Wiley & Sons, 2009.
3. Sedra and Smith," Microelectronic Circuits", 7th edition, Oxford University Press.

Course Title	Digital Electronics				Course Type		HC	
Course Code	B23EN0302	Credits	3		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	0	0	0				
	Total	3	3	3	39		50%	50%

COURSE OVERVIEW:

Digital Electronics is a very important course for Electronics Engineers as it deals with the fundamental aspects of digital circuits design. Both the Combinational and the sequential circuit realization and implementations are studied. The course is rich in numerical examples which help students to develop good analytical and logical skills. The course also has an opportunity to expose the students to the real-world problems and hence generates interest in studying the course. This course opens with an introduction to combinational logic, logic gates, minimization techniques, arithmetic circuits. It then moves to deal with sequential circuits: flip-flops, synthesis of sequential circuits, and case studies, including counters, registers. State machines will then be introduced. Different representations of truth table, logic gate, timing diagram, switch representation, state diagram, and state equations will be discussed.

COURSE OBJECTIVES:

The objectives of this course are to

1. Illustrate Boolean laws and systematic techniques for minimization of expressions.
2. Demonstrate the methods for simplifying Boolean expressions.
3. Familiarize the commonly used terms like min-term, max-term, canonical expression, SOP, POS etc
4. Introduce the Basic concepts of combinational and sequential logic.
5. Present real-world examples for making the learners attuned to Logic concepts.
6. Highlight the formal procedures for the analysis and design of combinational circuits and sequential circuits.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define a Boolean term, expression, SOP, POS, Min-term etc.	1,2,3,4,5	1,3
CO2	Construct the K-map from a Boolean expression and to find the minimal SOP/POS forms	1,2,3,4,5	1,3
CO3	Design arithmetic and combinational logic circuits using gates, encoders, decoders, multiplexers and de-multiplexers	1,2,3,4,5	1,3
CO4	Design specified synchronous or asynchronous sequential logic circuits using appropriate flip flops.	1,2,3,4,5	1,3
CO5	Design sequential circuits with Moore and Mealy configurations.	1,2,3,4,5	1,3
CO6	Design the applications of Combinational & Sequential Circuits.	1,2,3,4,5	1,3

BLOOM'S LEVEL OF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1								2		3
CO2	3	2	3	1	3								2		3
CO3	3	2	3	1	3								2		3
CO4	3	2	3	1	3								2		3
CO5	3	2	3	1	3								2		3
CO6	3	2	3	1	3								2		3

Note:1-Low,2 Medium,3-High

COURSE CONTENT

THEORY

CONTENTS
UNIT - 1 Boolean Algebra and Minimization Techniques of combinational Circuits: Basic Theorems and Properties of Boolean Algebra, canonical forms, Sum of Products and Product of sums simplification, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, Incompletely specified functions (Don't care terms).
UNIT – 2 Design of Combinational Logic Circuits: Code Conversion, Binary adders and subtractor, Parallel adder, Carry Look Ahead adder, BCD adder. Principle of Encoder and Decoder with cascading of decoders. Principle of Multiplexers and Demultiplexers, Cascading of Multiplexers, Realization of Digital Logic Circuits using Multiplexers and decoders, Comparators (1 and 2 bit)
UNIT - 3 Design of Sequential Logic Circuits: Latches- SR, D: Flipflops: D, T, SR, JK, The master-slave flip- flops, Shift Registers- SISO, SIPO, PISO, PIPO, Universal Shift Registers, Design of Counters: Asynchronous and Synchronous (Up/Down Counters), Design of a Modulo-n counter.

UNIT - 4

Sequential Circuit Design using State Machines: Introduction to Mealy and Moore FSM, Synchronous sequential circuit analysis and construction of state table and diagram, State reduction techniques, Design of a Sequence Detector with overlapping, Serial Adder with Accumulator, Design of 2*2 Binary Multiplier and Design of Traffic Light Controller.

TEXT BOOKS:

1. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2002.
2. Morris Mano, "Digital design‖, Prentice Hall of India" Third Edition.
3. John M Yarbrough, "Digital Logic Applications and Design" Thomson Learning,2001.

REFERENCE BOOKS:

1. Charles H Roth Jr., Larry L. Kinney "Fundamentals of Logic Design" Cengage Learning, 7th Edition.
2. Samuel C Lee, "Digital Circuits and Logic Design" PHI learning, 1st Edition, 2009

JOURNALS/MAGAZINES:

1. https://en.wikipedia.org/wiki/Digital_electronics
2. https://learnabout-electronics.org/Digital/dig10.php
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials
4. https://www.youtube.com/watch?v=CeD2L6KbtVM
5. https://www.youtube.com/watch?v=BqP6sVYlrr0
6. https://www.youtube.com/watch?v=ibQBb5yEDlQ

SWAYAM/NPTEL/MOOCs:

1. http://nptel.ac.in/courses/117106086/6
2. http://nptel.ac.in/courses/117105080/12
3. http://nptel.ac.in/courses/117105080/21
4. http://nptel.ac.in/courses/117106086/26

<table>
<tr><td>Course Title</td><td colspan="3">Network Analysis and Synthesis</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22EN0303</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III semester</td></tr>
<tr><td rowspan="6">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>0</td><td>3</td><td>42</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course introduces the concepts to determine voltage, current and power in branches of any circuits excited by dc and ac voltages and current sources by simplifying techniques to solve dc circuit problems using basic circuit theoremsand structured methods like node voltage and mesh current analysis. The goal also includes derivation of the transientresponses of RC and RL circuits, steady state response of circuits to sinusoidal excitation in time domain, introduction to two port networks and application of Laplace transform in network theory. The course also includes the concepts of synthesizing a network from its admittance functions.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Understand the concepts of super mesh, super node and network theorems.
2. Evaluate two port network parameters to simplify the network computations.
3. Analyze the excitation response of the electrical network and the techniques for characterizing the networksusing network parameters.
4. Construct an analysis strategy to determine a particular transient response of passive electrical network.
5. Synthesize a network from its network functions.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Evaluate the branch currents and node voltages of any given electrical circuit by the application of super-mesh, super-node and various network theorems.	1,2,3,4	1,2,3
CO2	Model a two port network in terms of Z, Y, h & T parameters.	1,2,3,4	1,2,3
CO3	Design the resonant circuits for given frequency and compute the performanceparameters	1,2,3,4	1,2,3
C04	Apply initial and final conditions to analyze transient behavior of network.	1,2,3,4	1,2,3
CO5	Apply Laplace transform technique to analyze the transient behavior of series andparallel RLC circuits.	1,2,3,4	1,2,3
CO6	Synthesize one port networks using Foster and Cauer Forms.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		

CO6	√	√	√	√		

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									1	1	2
CO2	3	3	3	2									1	1	2
CO3	3	3	3	2									1	1	2
CO4	3	3	3	2									1	1	2
CO5	3	3	3	2									1	1	2
CO6	3	3	3	2									1	1	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY

Contents
UNIT-1 **Network Analysis Techniques & Theorems:** Mesh Analysis: Super-mesh, Nodal Analysis: super-node for ac and dc n/w's, Network Theorems: Superposition theorem, Thevenin's theorem (Norton's equivalent circuit from Thevenin's), Maximum power transfer theorem for ac and dc n/w's. Numerical examples on each topic.
UNIT-2 **Two Port Networks:** Definition of Z, Y, h & T parameters, Inter-relationships between parameters. Numerical examples. **Resonance Circuits:** R-L-C Series & R||L||C Parallel resonance (resonant frequency, cut-off frequencies, bandwidth, dynamicimpedance, quality factor-derivations included for series resonance and parallel resonance), Numericals.
UNIT-3 **Transient Analysis using LT:** Initial & Final conditions of network elements. Evaluation of initial and final conditions in RL, RC and RLC circuits with AC and DC excitations. Application of Laplace transform technique: Review of Laplace transformation; Laplace transform of network and time domain solution for RL, RC and RLC networks for AC and DC excitations; Transient behaviour of circuit elements under switching conditions and their representations, Numerical.
UNIT-4 **Network Synthesis:** Introduction, System/Transfer Functions, Driving point functions**,** Pole-zero representation of system function, Hurwitz polynomials, Positive real functions, Elementary synthesis concepts, Realization of LC, RC & RL functions: Foster I & II Forms, Cauer I & II Forms, Numericals.

TEXT BOOKS:

1. W H Hayt, J E Kemmerly, S M Durbin, "Engineering Circuit Analysis", 6th Edition, Tata McGraw-Hill Publication,2011.
2. R R Singh, "Network Analysis and Synthesis", 2nd edition, Tata McGraw-Hill Publication, 2019.
3. A Chakrabarti, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai & Co.,2013.

REFERENCE BOOKS:

1. Nahvi, Edminister, “Electric Circuits”, Schaum’s Outline Series, McGraw Hill, 2003.
2. J. David Irwin, R. Mark Nelms, “Basic Engineering Circuit Analysis”, 8th edition, John Wiley, 2006.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.circuitbasics.com/circuit-analysis/
2. https://openpress.usask.ca/physics155/chapter/7-advanced-circuit-analysis-techniques/
3. https://web.stanford.edu/class/engr108/lectures/circuits.pdf

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/content/storage2/108/105/108105159/MP4/mod01lec01.mp4
2. https://nptel.ac.in/content/storage2/108/105/108105159/MP4/mod01lec02.mp4
3. https://nptel.ac.in/content/storage2/108/105/108105159/MP4/mod01lec04.mp4
4. https://nptel.ac.in/content/storage2/108/105/108105159/MP4/mod01lec06.mp4
5. https://nptel.ac.in/content/storage2/108/105/108105159/MP4/mod06lec45.mp4

SELF-LEARNINGEXERCISES:

1. Transient Analysis of RL and RC circuit with AC and DC excitations using LTSpice/TINA software tool.

<table>
<tr><td>Course Title</td><td colspan="4">Object-Oriented Programming using C++</td><td colspan="2">Course Type</td><td colspan="2">HC (Integrated)</td></tr>
<tr><td>Course Code</td><td>B23EN0304</td><td>Credits</td><td colspan="2">4</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact</td><td>Work</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>4</td><td>5</td><td>5</td><td>42</td><td>28</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

Object-oriented programming (OOP) is a programming paradigm that is oriented towards programming "real world objects", which can contain data and methods to manipulate that data. C++ is a powerful and flexible programming language that supports both procedural programming and OOP concepts. This course will provide a comprehensive introduction to OOP using C++. The course will cover the basics of C++ programming, including data types, control structures, functions, arrays, pointers, and classes. The course will then move on to cover OOP features such as encapsulation, inheritance, and polymorphism and also delve in the concepts of Exception and File Handling.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the fundamental concepts of object-oriented programming and how they are implemented in C++.

2. Gain proficiency in C++ procedural programming, including the use of data types, control structures, functions, arrays, pointers, and classes.

3. Develop an understanding of object-oriented programming features such as encapsulation, inheritance, and polymorphism, and be able to apply these concepts to solve programming problems.

4. Learn how to use files and exceptions in C++ to write more efficient and robust code.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply good programming principles/practices to the design and implementation of C++ programs.	1,2,3	1,2,3
CO2	Demonstrate the syntax and semantics of C++ programming by using data types, control structures, pointers and functions to solve simple problems.	1,2,3,5	1,2,3
CO3	Apply object-oriented features like classes and objects to develop C++ applications.	1,2,3,5	1,2,3
CO4	Demonstrate and use the concept of inheritance and polymorphism for code reusability.	1,2,3,5	1,2,3
CO5	Apply concepts like File handling, Exception handling and Templates to write robust programs in C++.	1,2,3,5	1,2,3
CO6	Use an appropriate programming environment to design, code, compile, run and debug object-oriented C++ programs.	1,2,3,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✓	✓	✓			
CO2	✓	✓				
CO3	✓	✓	✓	✓		
CO4	✓	✓				
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										1	1	1
CO2	3	2	1		3								2	1	2
CO3	3	2	2		3								2	1	2
CO4	3	2	2		3								2	1	2
CO5	3	2	1		3								2	1	2
CO6	3	2	2		3								2	1	2

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1
The Basics of C++ Language: Introduction to C++ Programming, The General Form of a C++ Program, Data types and Variables, the const-Qualifier, Operators, Branching and Looping Statements, Array Types, String Types, Vectors, Pointer Types, Reference Types, Enumeration Types.
UNIT – 2
Functions and Object-Oriented Programming: Functions: User defined functions, function definition vs declaration, Parameter Passing Techniques, Recursive Functions. OOP: Procedure Oriented vs Object-Oriented Programming, Features of Object-Oriented Programming, Class, Objects, Data Member, Member Functions, Constructors and its Types, Destructors, Friend Functions, Dynamic Memory Allocation/Deallocation-New and Delete Keywords.
UNIT – 3
Inheritance and Polymorphism: Inheritance: Different types of Inheritances, Single Inheritance – Public, Private and Protected. Multiple Inheritance, Polymorphism: Introduction, Compile Time Polymorphism (function overloading) and Run Time Polymorphism (Virtual Functions), Operator Overloading.
UNIT – 4
Files, Exception Handling and STL: Files and Streams: Opening a file, closing a file, writing to a file, Reading from a file, File Position Pointers. Exception Handling: Exception handling fundamentals, Standard Exceptions, throwing exceptions, catching exceptions. Introduction to Standard Template Library (STL).

PRACTICE SESSIONS:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability

1.	a. Write a source code in C++ to generate all even and odd numbers between 1 and N. Value of N should be read at runtime. b. Write a source code in C++ to generate all the prime numbers between 1 to 20.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming Concepts
2.	a. Write a source code in C++ to read an array of size 10 at runtime and to find the largest and smallest number in the array. b. Write a source code in C++ to read an array of size 10 at runtime and to search an element within the array. Use any searching technique.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming Concepts and basic Data Structures.
3.	a) Write a source code in C++ to find the factorial of N using recursive functions. b) Write a source code in C++ to illustrate the concepts of parameter passing techniques in functions using Pass by Value and Pass by reference.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming Concepts
4	Write a source code in C++ to create a datatype "Student" with data members Name, Age and SRN. Perform operations of standard input and output on an object of Student class. Incorporate features of encapsulation and data abstraction.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts
5	Write a source code in C++ to create a datatype "Human" with data members Name, Age and Gender. Perform operations of standard input and output on an array of 5 objects. Incorporate features of encapsulation and data abstraction.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts
6	a) Write a source code in C++ to illustrate the need for Constructors. b) Write a source code in C++ to illustrate the need for new and delete expression.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts
7.	Write a source code in C++ to illustrate the need for a) Single Inheritance b) Multiple Inheritance.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts

8.	Write a source code in C++ to illustrate: a) Different types of implementations of Compile Time Polymorphism b) Runtime polymorphism.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts
9.	Write a source code in C++ to illustrate the need for overloading the operator "+" to perform addition on multiple data members.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming and OOP Concepts
10.	a) Write a source code in C++ to perform file handling operations. b) Write a source code in C++ illustrate the concept of Exception Handling.	Algorithms/Flowcharts, C++ Source Code, C++ Compiler	Procedural Programming

TEXT BOOKS:

1. Stanley B. Lippmann, JoseeLajore: "C++ Primer", Pearson Education, 4th Edition, 2005
2. Herbert Schildt , "The Complete Reference C++", McGraw-Hill, 4thEdition, 2003.

REFERENCE BOOKS

1. Bjarne Stroustrup, " The C++ Programming Language", Pearson Education, 4th Edition, 2003.
2. R.G.Dromey, "How to Solve it by Computer", Pearson, 2nd Edition, 2015.

Course Title	**Analog Electronics Lab**				**Course Type**			
Course Code	**B22EN0305**	**Credits**	**1**		**Class**		**III Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in	
	Lecture	-	-	-				
	Tutorial	-	-	-				
	Practical	1	2	2				
	-	-	-	-				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

In analog electronics lab the students can gain hands-on experience in designing, building, and testing electronic circuits that operate using continuous signals. The design and analysis of BJT biasing amplifier, MOSFET biasing and amplifier , BJT power amplifiers . Implementation of OP-amp as inverting, Non inverting, Summer sub tractor , integrator and differentiator.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand various biasing techniques for BJT
2. Demonstrate single stage BJT amplifier.
3. Demonstrate Single stage MOSFETCS amplifier
4. Analyse BJT power amplifiers.
5. Study various applications of Op-amp.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design and analyse BJT fixed bias and Self bias circuits	1,2,3,4,5,9, 10	1,2,3
CO2	Design and analyse Single stage BJT amplifier Emitter follower.	1,2,3,4,5,9, 10	1,2,3
CO3	Design and analyse MOSFET biasing circuits.	1,2,3,4,5,9, 10	1,2,3
CO4	Design and analyse single stage MOSFET amplifiers BJT power amplifiers.	1,2,3,4,5,9, 10	1,2,3
CO5	Construct and verify the operation of Op-amp as inverting, non-inverting, Summing and difference amplifier.	1,2,3,4,5,9, 10	1,2,3
CO6	Construct and verify the operation of op-amp as differentiator and Integrator	1,2,3,4,5,9, 10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1				2	2			2	1	3
CO2	3	2	3	1	3				2	2			2	1	3
CO3	3	2	3	1	3				2	2			2	1	3
CO4	3	2	3	1	3				2	2			2	1	3
CO5	3	2	3	1	3				2	2			2	1	3
CO6	3	2	3	1	3				2	2			2	1	3

Note:1-Low,2-Medium,3-High

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	ExpectedSkill /Ability
1	Design and Analysis of BJT CE Fixed, Self-Bias Circuits	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
2	Design and analysis of BJT CE amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
3	Design and analysis of BJT Emitter follower	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
4	Design and Analysis of MOSFET CS Self Bias Circuits.	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
5	Design and Frequency Analysis of MOSFET CS Amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
6	Design and analysis of Class-C tuned amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
7	Design and analysis of class B push pull power amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
8	Design and implementation of Op-amp inverting and non-inverting amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
9	Design and implementation of Op-amp Summing and Difference amplifier	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team
10	Design and implementation of Op-amp integrator and Differentiator	CRO, Function generator, power supply .Simulation tool	Design and circuit debugging. Working in a team

Extended learning: Simulate the above circuits using suitable simulation tool and analyze the performance.

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 11th edition, 2015.
2. David A. Bell, "Electronic Devices & Circuits", Prentice Hall of India/Pearson Education, 4th edition, 2007.
3. David A. Bell, "Operational Amplifiers and Linear ICs", Prentice Hall of India, 2nd edition, 2006.

REFERENCE BOOKS

Jacob Millman & Christos. C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits ",Tata McGraw Hill, 2nd edition, 2008.

Floyd, "Electronic Devices", Prentice Hall of India, Pearson Education, 6th Edition, 2010. Anil Kumar Maini, Varsha Agrawal,"Electronic Devices and Circuits", John Wiley & Sons, 2009.

Course Title	Digital Electronics Lab				Course Type		HC	
Course Code	B23EN0306	Credits	1		Class		III Semester	
	TLP	Credits	Contact	Work	Total Number of Classes		Assessment in	
	Lecture	-	-	-				
	Tutorial	-	-	-				
	Practical	1	2	2	Theory	Practical	IA	SEE
	Total	1	2	2	28	28	50%	50 %

COURSE OVERVIEW:

Electronics is classified based on the type of signal/information, in to Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified in to Combinational Logic/Circuits and Sequential Logic/Circuits. This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate Boolean laws and systematic techniques for minimization of expressions.
2. Demonstrate the methods for simplifying Boolean expressions.
3. Familiarize the commonly used terms like min-term, max-term, canonical expression, SOP,POS etc.
4. Introduce the Basic concepts of combinational and sequential logic.
5. Present real-world examples for making the learners attuned to Logic concepts.
6. Highlight the formal procedures for the analysis and design of combinational circuits and sequential circuits.
7. Introduce the concept of memories, programmable logic devices and digital ICs.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Verify Demorgan's theorem for 2 variables.	1,2,3,4,5,9, 10	1,2,3
CO2	Realize Half adder, Full adder , Half subtractor and Full subtractor using basic gates	1,2,3,4,5,9, 10	1,2,3
CO3	Realize binary to Grey conversion and Grey to binary conversion practically	1,2,3,4,5,9, 10	1,2,3
CO4	Construct and realize 4:1 MUX and DEMUX circuits	1,2,3,4,5,9, 10	1,2,3
CO5	Construct and verify the truth table of of JK master slave, T, D flip flops	1,2,3,4,5,9, 10	1,2,3
CO6	Construct and verify the truth table of counters and shift registers	1,2,3,4,5,9, 10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1				2	2			2	1	3
CO2	3	2	3	1	3				2	2			2	1	3
CO3	3	2	3	1	3				2	2			2	1	3
CO4	3	2	3	1	3				2	2			2	1	3
CO5	3	2	3	1	3				2	2			2	1	3
CO6	3	2	3	1	3				2	2			2	1	3

Note:1-Low,2-Medium,3-High

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	To Verify (i) Demorgan's Theorem for 2 variables. (ii) The sum-of product and product-of-sum expressions using universal gates.	IC Trainer Kit	Design of circuit. Working in a team
2	Realization of (i) Half Adder & Full Adder using i) basic gates. ii) NAND gates. (ii) Half subtractor& Full subtractor using i) basic gates ii) NAND gates	IC Trainer Kit	Design and circuit debugging. Working in a team
3	Realization of 4-bitParallel Adder/Subtractor using IC 7483.	IC Trainer Kit	Design and circuit debugging. Working in a team
4	Realization of 3 bit Binary to Grey code conversion and vice versa using basic/Universal gates.	IC Trainer Kit	Design and circuit debugging. Working in a team
5	Realization of 4:1 MUX and 1:4 DEMUX using basic/universal gates.	IC Trainer Kit	Design and circuit debugging. Working in a team

6	Arithmetic circuit realization (Half/Full, Adder/Subtractor) using MUX	IC Trainer Kit	Design and circuit debugging. Working in a team
7	Construction and verification of JK master slave, T, D flip flop using logic gates	IC Trainer Kit	Design and circuit debugging. Working in a team
8	Construction and realization of 3- bit ripple up/down counter using IC 7476 and other logic gates.	IC Trainer Kit	Design and circuit debugging. Working in a team
9	Design and verification of 3-bit synchronous counter using 7476 JK, T and D flip flops.	IC Trainer Kit	Design and circuit debugging. Working in a team
10	Realize the following shift registers using IC7474/7495(i) SISO (ii) SIPO (iii)) PISO(iv))PIPO	IC Trainer Kit	Design and circuit debugging. Working in a team
11.	Simulation of Digital Logic Circuits.	NI Multisim Simulator or any suitable simulators.	Design and circuit debugging. Working in a team

TEXT BOOKS:

1. John M Yarbrough, “Digital Logic Applications and Design” Thomson Learning,2001.
2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002.
3. Morris Mano, “Digital design‖, Prentice Hall of India” Third Edition.

REFERENCE BOOK:

1. Charles H Roth Jr., Larry L. Kinney “Fundamentals of Logic Design” Cengage Learning, 7th Edition.
2. Samuel C Lee, “Digital Circuits and Logic Design” PHI learning, 1st Edition, 2009

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://en.wikipedia.org/wiki/Digital_electronics
2. https://learnabout-electronics.org/Digital/dig10.php
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials
4. https://www.youtube.com/watch?v=CeD2L6KbtVM
5. https://www.youtube.com/watch?v=BqP6sVYlrr0
6. https://www.youtube.com/watch?v=ibQBb5yEDlQ

Course Title	**Course Based Project on Analog and Digital Electronics**			**Course Type**			
Course Code	**B22EN0307**	**Credits**	**1**	**Class**		**III Semester**	
Course Structure	L-T-P	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in
	Lecture	0	0	0			
	Tutorial	-	-	-	Theory	Practical	
	Practice	1	2	2			IA SEE
	Total	**1**	**2**	**2**		**28**	**50 % 50**

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because, this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

COURSE OBJECTIVES:

The objectives of this course are:

1. Integrate knowledge and skills learnt from theory concepts to build projects
2. Design solution to Engineering/real time problems

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Build hardware to solve real time /Engineering problems	1,2,3,4,5,9,	1,2,3
CO2	Apply appropriate technique to solve Engineering problems	1,2,3,4,5,9,	1,2,3
CO3	Present the innovative ideas in building the projects	1,2,3,4,5,9,	1,2,3
CO4	Develop an individual as responsible team member	1,2,3,4,5,9,	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				3	3	1	1	2	2	1
CO2	3	3	3	3	2				3	3	1	1	3	2	

CO3	3	3	3	3	2				3	3	1	1	3	3	2
CO4	3	3	3	3	2				3	3	1	1	3	3	2

Note:1-Low,2-Medium,3-High

Guidelines to carry out project

1. The project is carried out by team of two or three students (student team).
2. Each Student team is guided and monitored by Faculty, the Course coordinator for Linear Integrated Circuits will be the Coordinator for Course based Project (CBP) Course.
3. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.
4. The activities for each week will be assigned.
5. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.
6. In the laboratory training, students carry out practices according to the project stages.

ASSESSMENT AND EVALUATION:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise by Faculty in charge.
2. The external evaluation is made on written reports, oral presentation and demonstration of project results with developed model at the end of the semester by Examiner.

Course Title	**Universal Human Values**				**Course Type**		FC	
Course Code	**B22EE0310**	**Credits**	2		**Class**		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	0				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practice	0	0	0				
	Total	2	2	0	28	0	50%	50%

COURSE OBJECTIVE

1. Development of a holistic perspective based on self- exploration about themselves (human being), family,society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	**Course Outcomes**	**POs**	**PSOs**
CO1	Understand the significance of value inputs in a classroom and start applyingthem in their life and profession.	6,7,8	1
CO2	Distinguish between values and skills, happiness and accumulation of physicalfacilities, the Self and the Body, Intention and Competence of an individual, etc.	6,7,8	1

CO3	Understand the role of a human being in ensuring harmony in society andnature.	6,7,8	1
CO4	Demonstrate the role of human being in the abetment of pollution.	6,7,8	1
CO5	Describe appropriate technologies for the safety and security of the society asresponsible human being.	6,7,8	1
CO6	Distinguish between ethical and unethical practices and start working out thestrategy to actualize a harmonious environment wherever they work.	6,7,8	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyse (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		**√**	**√**			
CO2		**√**	**√**			
CO3		**√**	**√**			
CO4		**√**	**√**			
CO5		**√**	**√**			
CO6		**√**	**√**			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	2	1					1	
CO2						3	2	1					1	
CO3						3	2	1					1	
CO4						3	2	1					1	
CO5						3	2	1					1	
CO6						3	2	1					1	

Note: 1-Low, 2-medium, 3-High

COURSE CONTENT

Content
Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happinessand Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs ofSelf ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

Unit - 2
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co- existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
Unit - 3
Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Unit - 4
Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics ofpeople friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management modelsand production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, ExcelBooks, New Delhi, 2010
4. Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

REFERENCE BOOKS:

1.Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997

2.I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970

3.Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993

EVALUATION PATTERN:

· Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment

· Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.

· Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	Technical Documentation				Course Type		FC	
Course Code	B22EN0308	Credits	1		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**1**	**1**	**1**	**14**	**-**	**50%**	**50 %**

COURSE OVERVIEW: Technical writing is all about strategically placing facts and figures in a sensible and user-understandable way. A structured approach encourages creating a better output, all the while considering available resources and objectives. This course focusses on various factors to improve the skills of Technical documentation.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Acquire language skills
2. Develop linguistic and communicative competencies
3. Study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Produce effective engineering documents that enable readers to access relevant information.	6,8,9,10,12	**1**
CO2	Learn to avoid communication problems that distract the readers, causing confusions, distrust, or misunderstanding.	6 8,9,10,12	**1**
CO3	Practice various verbal reasoning and grammar practice.	6,8,9,10,12	**1**
CO4	Search engineering information, both in traditional ways and online.	6,8,9,10,12	1
CO5	Write research/design reports with special emphasis on content and style.	6,8,9,10,12	1
CO6	Improve the art of presentations in team	6,8,9,10,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2	√	√	√			
CO3		√				
CO4		√				
CO5		√	√			

CO6		√	√			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1		1	2	2		2	1		
CO2						1		1	2	2		2	1		
CO3						1		1	2	2		2	1		
CO4						1		1	2	2		2	1		
CO5						1		1	2	2		2	1		
CO6						1		1	2	2		2	1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Information Design and Development**- Different kinds of technical documents, Information development life cycle, factors affecting information and document design, Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.
UNIT-2 **Advanced Technical Communication :**Introduction to advanced technical communication, Usability, Managing technical communication projects, time estimation, Single sourcing, Localization, Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

TEXT BOOKS:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004

2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

4.Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

5.Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)

6.Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).

EVALUATION PATTERN:

Since Technical documentation is 1 credit course and asper the regulations 23-24, IA1 and IA2 will not be conducted however internal assessment marks of 25 will be awarded based on two assignments/quizzes/presentation.

- **Semester End Exam is for 25 Marks and evaluation is based on the Technical report prepared by the students and viva-voce. This exam will be conducted during semester end practical examination slot.**

Course Title	Indian Constitution				Course Type		MC	
Course Code	B22MEM301	Credits	0		Class		III/IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	0	2	2				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practice	0	0	0				
	Total	0	2	2	30	0	50 %	50 %

COURSE OVERVIEW

The Constitution of India lays down in defining fundamental political principles, establishes the structure, procedures, powers and duties of government institutions and sets out fundamental rights, directive principles and duties of citizen. It helps to know and understand state executive and elections system of India.

COURSE OBJECTIVES

The objectives of this course are to:

1. Know about the basic structure of Indian Constitution.
2. Know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.
3. Know about our Union Government, political structure & codes, procedures.
4. Know the State Executive & Elections system of India.
5. Learn the Amendments and Emergency Provisions, other important provisions given by the constitution

COURSE OUTCOMES (Cos)

After the completion of the course, the student will be able to:

CO	Course Outcomes	POs	PSOs
CO1	Analyse the basic structure of Indian Constitution	6,8,9, 12	
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution	6,8,9, 12	
CO3	Know about Indian Union Government, political structure & codes, procedures.	6,8,9, 12	
CO4	Understand our State Executive & Elections system of India	6,8,9, 12	
CO5	Understand the Amendments and Emergency Provisions, other important provisions given by the constitution	6,8,9, 12	

CO6	Understand constitutional amendments till today	6,8,9, 12	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1				√		
CO2		√				
CO3		√				
CO4		√				
CO5		√				
CO6		√				

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2		1	1			1			
CO2						2		1	1			1			
CO3						2		1	1			1			
CO4						2		1	1			1			
CO5						2		1	1			1			
CO6						2		1	1			1			

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

Unit – 1
Indian Constitution: Necessity of the constitution, societies before and after the constitution adoption, introduction to the Indian constitution, making of the constitution, role of the constituent assembly.
Unit – 2

Salient features of India Constitution: Preamble of Indian constitution and key concepts of the preamble, fundamental rights and its restriction and limitations in different complex situations.
Unit – 3 DPSP's and Fundamental Duties: Directive Principles of State Policy (DPSP's) and its present relevance in Indian society, fundamental duties and its scope and significance in nation, union executive: parliamentary system, union executive – president, prime minister, union cabinet.
Unit – 4 Executive and Elections system of India: Parliament - LS and RS, parliamentary committees, important parliamentary terminologies, judicial system of India, supreme court of India and other courts, judicial reviews and judicial activism, state Executive and Governer, CM, state cabinet, legislature - VS & VP, election commission, elections and electoral process, amendment to constitution, and important constitutional amendments till today, emergency provisions.

TEXT BOOKS

1. Kapoor, S.K., "Human rights under International Law and Indian Law", Prentice Hall of India, New Delhi, 2002.

2. Basu, D.D., "Indian Constitution", Oxford University Press, New Delhi, 2002.

REFERENCES BOOKS

1. M V Pylee, "An Introduction to Constitution of India", S Chand & Company, 5th Edition.

2. Durga Das Basu, "Introduction to constitution of India", LexisNexis, 23rd Edition.

EXAMINATION PATTERN:

The course is Mandatory course, As per the regulations 23-24 no IA tests or assignments for the course evaluation. Semester End Examination question paper is of MCQ pattern set for maximum marks of 50. Marks obtained is scaled down to 25.

Detailed Syllabus

IV Semester

Title	Probability random process				Course Type		Theory	
Course Code	B23AS0402	Credits	4		Class		IV sem	
Course	TLP	Credits	Contact	Work	Total Number of Classes		Assessment Weightage	
	Theory	3	3	3				
	Practice	-	-	-				
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The course presents the fundamentals of probability theory and random processes needed by students in communications, signal processing, computer science and other disciplines. Topics include: axiomatic probability theory; discrete and continuous random variables; functions of random variables; generating functions ; random processes; ; Markov chains; random walks, Brownian motion, diffusion and Ito processes.

COURSE OBJECTIVE

The objectives of this course are to:
1. Familiarize with basic concepts of statistics.
2. Understand the concept of random variable and probability distributions.
3. understand joint probability distribution and Markov Chain
4. Learn about sampling and Testing of hypothesis for small and large sample.

COURSE OUTCOMES (COs): After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions.	1,2,3,4	1,2,3
CO2	Calculate probabilities, and derive the marginal distributions of bivariate random variables.	1,2,3,4	1,2,3
CO3	Solve Binomial, Poisson's, Exponential and Normal distributions problems	1,2,3,4	1,2,3
CO4	Calculate probabilities of absorption and expected hitting times for discrete time Markov chains with absorbing states.	1,2,3,4	1,2,3
CO5	Translate real-world problems into probability mode	1,2,3,4	1,2,3

CO6	Apply Sampling distribution to solve Engineering problems	1,2,3,4	1,2,3
CO6	Apply sampling theory concepts to solve various engineering problems.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	
CO6	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1									2	2	1
CO2	3	2	2	2									2	2	1
CO3	3	3	2	1									2	2	1
CO4	3	2	2	1									2	2	1
CO5	3	3	2	1									2	2	1
CO6	3	3	2	1									2	2	1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents

UNIT – 1

Statistics: Mean, Mode, Median and standard deviation. Correlation, Coefficient of correlation and lines of regression. Rank correlation, Moments, skewness, kurtosis. Curve fitting by the method of least squares- Fitting curves of the form, $y = ax + b,\ \ y = ab^x, y = ae^{bx}, y = ax^2 + bx + c.$

MATLAB experiments:

Finding means, mode and median.

Fitting of straight-line, second-degree parabola and exponential curves.

Finding the correlation coefficient for the given data.

UNIT – 2

Probability and Statistics: Random variables (discrete and continuous), Probability density function, probability distribution – Binomial, Poisson's, Exponential and Normal distributions and problems. [with proof for mean & SD for all distributions], probable error. Normal approximation to binomial distribution.

MATLAB experiments:

Finding the probabilities of pdf – Binomial and Poisson's distribution.

UNIT – 3

Joint Probability distribution: - Concept of joint probability, joint distributions – (both discrete and continuous random variables), independent random variables, problems on expectation and variance.

Markov chain: Probability vectors, stochastic matrices, Fixed points, Regular stochastic matrices, Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

MATLAB experiments:

Finding the probabilities of Joint probability distribution fuctions.

UNIT - 4

Sampling distribution: Sampling, Sampling distributions, standard error, Testing of hypothesis, Type I and Type II errors. Level of significance. Confidence limits of means, One tailed and two-tailed tests. Fitting Theoretical distribution to sample frequency distributions. Student's t-distribution, Chi-square distributions and F-distributions.

MATLAB experiments:

Testing the hypothesis for small and large samples.

Testing the frequency distribution – Chi – Square distribution.

TEXT BOOKS:

1. Higher Engineering Mathematics by B.V. Raman Publisher: TMH
2. Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley &SonsInc- 8th Edition

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson
2. Mathematical Methods by Potter & Goldberg; Publisher: PHI.

JOURNALS/MAGAZINES:

https://nptel.ac.in/noc/courses/noc15/SEM2/noc15-ec07/

https://www.youtube.com/watch?v=dSej7AHlim4

SWAYAM/NPTEL/MOOCs:

https://onlinecourses.nptel.ac.in/noc21_ma66/preview

https://onlinecourses.nptel.ac.in/noc20_ee16/preview

Course Title	**Linear Integrated Circuits**				**Course Type**			
Course Code	**B22EN0401**	**Credits**	**3**		**Class**		**IV Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practical	-	-	-	Theory	Practical	**IA**	**SEE**
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

Linear Integrated Circuits introduces the basic building blocks of Operational amplifiers, stabilization techniques, testing and feedback techniques. The Course also introduces to the design of applications related to analog computation, measurements, rectification, active filtering, timers, Data Converters. This co to analog computation, measurements, rectification, active filtering, timers, Data Converters. This course supports acquiring of knowledge in analysis and design of IC based circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the internal components and characteristics and frequency response of Operational amplifier.
2. Explain the linear, non-linear applications of Op-Amp and active filters.
3. Comprehend the applications of Op-Amp as comparators, waveform generators, VCO and PLL operation and its application
4. Discuss various applications of special function Op-Amp ICs such as 555 IC, Voltage Regulator IC
5. Understand the performance of various types of ADC and DAC using Op-Amp

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the internal components, characteristics and frequency response of Op-Amp.	1,2,3,4,5	1,2,3
CO2	Identify the linear, non-linear applications of Op-Amp and active filters.	1,2,3,4,5	1,2,3
C03	Analyze the operational amplifier applications as Wave form generators.	1,2,3,4,5	1,2,3
CO4	Categorize Op-Amp based comparators, waveform generators, VCO and PLL operation and its application.	1,2,3,4,5	1,2,3
CO5	Design various applications of special function Op-Amp ICs such as 555 timer, Voltage Regulator IC.	1,2,3,4,5	1,2,3
CO6	List and compare the performance of various types of ADC and DAC using Op-Amp	1,2,3,4,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1								3	3	1
CO2	3	3	3	2	1								3	3	1
CO3	3	3	3	2	1								3	3	1
CO4	3	3	3	2	1								3	3	1
CO5	3	3	3	2	1								3	3	1
CO6	3	3	3	2	1								3	3	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1
OP-AMPS Frequency Response, Compensation and applications:
Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, Circuit stability, frequency and phase response, frequency compensating

methods, bandwidth, and slew rate effects,. Linear Applications: Voltage sources, current sources and current sinks, Current amplifiers, Instrumentation amplifier, precision rectifiers

UNIT – 2

Non-linear applications of OP-AMP

Clamping circuits, peak detectors, Sample and hold circuit, V-I and I-V converter, Log and Antilog amplifiers, Multiplier and Divider, Triangular/Rectangular waveform generators, waveform generator design .Crossing detectors, Inverting Schmitt trigger circuits, Active filters- first and second order low pass and high pass filters

UNIT – 3

Voltage regulators, 555 timer and PLL

Series op-amp regulator, IC voltage regulator, 723 general purpose regulators, 555 timer-basic timer circuit, 555,timer used as Astable and Monostable multivibrator, IC565 PLL - Block Schematic, Description of Individual Blocks,Applications.

UNIT – 4

DATA CONVERTERS:

Introduction, DAC and ADC Specifications. Basic DAC techniques**,** Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Different Types of ADCs - Parallel Comparator Type ADC, Single and dual slope ADC, Successive Approximation ADC,

TEXT BOOKS:

1. David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004
2. D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006
3. R. Gayakwad, "Op-amps and Linear Integrated Circuits" (4/e), PHID. A. Bell, Solid state Pulse Circuits (4/e), PHI, 2009

REFERENCE BOOK:

1. Thomas L. Floyd, David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1999
2. Bruce Carter," Op Amps for Everyone", ISBN: 978-0-12-391495-8, Fourth Edition.
3. BIS, ISO standards and Datasheet

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. IEEE transactions on Circuits and Systems
2. https://en.wikipedia.org/wiki/List_of_linear_integrated_circuits
3. http://www.fairchildsemi.com/an/AN/AN-88.pdf
4. https://www.onsemi.com/pub/Collateral/AN-118.pdf.pdf
5. https://www.onsemi.com/pub/Collateral/AN-140.pdf.pdf
6. https://web.archive.org/web/20130502174545/http://www.fairchildsemi.com/an/AN/AN-340.pdf

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/108/108108111/

2. https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2
3. https://www.coursera.org/lecture/electronics/2-5-active-filters-L2ASa
4. https://www.coursera.org/lecture/sensors-circuit-interface/3-basic-amplifiers-sojqu
5. https://www.coursera.org/lecture/internet-of-things-sensing-actuation/op-amps-kxEOi
6. https://static1.squarespace.com/static/60494675b50d044ae4a81842/t/604a10a95e0cc12e7de634d5/1615466669126/analog_circuit_design_coursera.pdf

<table>
<tr><td>Course Title</td><td colspan="4">Analog Communication</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22EN0402</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="6">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number ofClasses Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td>IA</td><td>SEE</td></tr>
<tr><td>-</td><td></td><td></td><td></td><td rowspan="2">50%</td><td rowspan="2">50%</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td></td></tr>
</table>

COURSE OVERVIEW:

This course provides the basics of analog communication systems such as amplitude modulation and demodulation, DSB-SC modulation and demodulation, SSB and VSB modulation and demodulation. Later, comparison of various modulation schemes is carried out to differentiate all amplitude modulation schemes. Frequency division multiplexing and frequency translation are demonstrated with block diagram. Angle modulation and demodulation techniques are illustrated to providea better insight of the course. Finally, the course provides introduction to noise and analyze the receiver model in presence of the noise. This fundamental knowledge on analog communication helps to explore and apply the techniques in design of various analog communication systems.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Comprehend the knowledge of various Analog modulation & demodulation schemes.
2. Understand the time domain and frequency domain description of AM, DSBSC, SSB and VSB schemes
3. Comprehend the knowledge of frequency modulation schemes
4. Introduce the fundamental concepts of noise in communication systems

COURSE OUTCOMES:

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Derive the time domain representation of Amplitude modulation, DSB-SC and hence sketch the frequency spectrum of AM and DSB-SC	1,2,3,4,5,9,10	1,2,3
CO2	Analyze time domain and frequency domain problems of SSB and VSB schemes	1,2,3,4,5,9,10	1,2,3
CO3	Categorize the features and applications of all amplitude modulation Schemes.	1,2,3,4,5,9,10	1,2,3
CO4	Illustrate FM modulation and Demodulation Schemes	1,2,3,4,5,9,10	1,2,3
CO5	Relate AM , FM and PM modulation schemes	1,2,3,4,5,9,10	1,2,3

CO6	Devise the model of AM and FM receivers	1,2,3,4,5,9,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1				1	1			1	2	1
CO2	3	3	3	2	1				1	1			3	2	1
CO3	3	3	3	2	1				1	1			2	3	3
CO4	3	3	3	2	1				1	1			3	2	1
CO5	3	3	3	2	1				1	1			2	3	2
CO6	3	3	3	2	1				1	1			3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Theory:

Contents
UNIT – 1 **Amplitude modulation:** Electromagnetic Spectrum used in communication, concept of bandwidth and power. Modulation , need for modulation, Classifications, AM, Frequency – Domain description. Generation of AMwave: square law modulator, switching modulator. Detection of AM waves: square law detector, Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, Coherent detection of DSBSC modulated waves. Costas loop. Related numerical
UNIT - 2 **Single Side Band (SSB) and Vestigial Side Band (VSB) transmission:** Quadrature Carrier Multiplexing, Introduction to Hilbert Transform, properties of Hilbert Transform, Pre-envelope, Complex-envelope, Single Side-Band Modulation, Frequency-Domain and Time-Domain Description of SSB, Phase Discrimination Method for Generating an SSB Modulated Wave. Demodulation of SSB Waves, VSB: Frequency Domain Description, Generation and Coherent detection of VSB, Applications of SSB VSB modulation in television. Comparison of Amplitude Modulation Techniques. Frequency Division Multiplexing, Frequency Translation. Related numerical

UNIT - 3
Angle Modulation and Pulse Analog Modulation: Basic Definitions, FM, PM, Narrow Band FM, Wide Band FM(with Bessel function), Transmission Bandwidth of FM Waves, Generation of FM Waves: Indirect FM And Direct FM. Demodulation of FM Wave- Balanced Frequency discriminator, Phase Locked Loop. Pulse modulation schemes – PAM, PPM and PWM
Unit-4
Introduction to Noise and Noise in Continuous Wave Modulation Systems: Introduction, Noise and its types :Shot Noise, Thermal Noise, White Noise, Noise Equivalent BW, Narrow Bandwidth,Noise Figure, Equivalent Noise Temperature, Cascade Connection of Two-Port Networks, Receiver Model, Noise in AM Receivers,Noise In DSB-SC Receivers, Pre-Emphasis and De-Emphasis in FM. Related numerical

TEXT BOOKS:

1. Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley, 3rd Edition 2003.
2. Simon Haykins, "Communication Systems", John Willey 4th Edition, 2001.

REFERENCE BOOK:

1. B. P. Lathi, "Modern digital and analog Communication systems", Oxford University press, 3rd Edition, 2005.
2. Kennedy, Davis," Electronic Communication Systems ", Tata Mcgraw-Hill, 4th Edition, 1999.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://ieeexplore.ieee.org/document/1456366
https://ieeexplore.ieee.org/abstract/document/1054507
https://onlinelibrary.wiley.com/toc/10991131a/4/1
https://www.youtube.com/watch?v=00ZbuhPruJw
https://www.youtube.com/watch?v=beFoCZ7oMyY
https://www.youtube.com/watch?v=A6BRXPqxya0

SWAYAM/NPTEL/MOOCs:

https://www.coursera.org/lecture/satellite-communications/from-analog-to-digital-AUNu1 https://www.classcentral.com/course/swayam-analog-communication-13893 https://onlinecourses.nptel.ac.in/noc20_ee69/preview

Course Title	Electromagnetics and Transmission lines				Course Type			
Course Code	B22EN0403	Credits	3		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	1	2	2				
	Practice	0	0	0	Theory+ Tutorial	Practical	IA	SEE
	Total	3	5	4	28+28	-	50%	50%

COURSE OVERVIEW:

The course covers the basic principles of electromagnetics: The experimental laws, electrostatics, magnetic fields of steady currents, potential, Laplace's and Poisson's law, Maxwell's equations, propagation and radiation of electromagnetic waves. The course mainly deals with understanding the properties of electric and magnetic fields which helps to understand the Maxwell's equations which are governing communication in any media. The course also gives an insight to generation of electromagnetic waves and to understand their behavior in different media. Fundamentals of Transmission line ,properties, performance parameters and applications.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the implementation of Maxwell's equation for electrostatic fields
2. Elaborate the concept of electromagnetic waves and their practical applications through different media.
3. Study the propagation, reflection, and transmission of plane waves in bounded unbounded media.
4. Comprehend the properties of Transmission lines

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Obtain electric field intensity due to different types of charge distribution in a static electric field.	1,2,3,4	1,2,3
CO2	Apply gauss-divergence theorem to establish Maxwell's equation and to interpret them in the potential field.	1,2,3,4	1,2,3
CO3	Apply Biot-Savart's and Ampere's circuital law to determine the magnetic field intensity due to different current carrying conductors.	1,2,3,4	1,2,3
CO4	Establish analyze the Maxwell's equations for time-varying electromagnetic fields.	1,2,3,4	1,2,3
CO5	Obtain and solve the EM wave equations for lossy and lossless medium.	1,2,3,4	1,2,3
CO6	Compare the characteristics of a transmission line for various load conditions.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	2	1
CO2	3	3	3	3									3	2	1
CO3	3	3	3	3									3	2	1
CO4	3	3	3	3									3	2	1
CO5	3	3	3	3									3	2	1
CO6	3	3	3	3									3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Electrostatics: Coulomb's Law, Electric Field Intensity - Fields due to Different Charge Distributions (point, line and volume charge distributions only), Electric Flux and density, Relation between E and D, Gauss Law and its Applications, Maxwell's I equation, Divergence theorem.
UNIT – 2
Potential Field: Potential difference between two points in an electric field (only up to Maxwell's II equation), Electric Scalar Potential, Continuity Equation, Boundary Conditions between two perfect dielectrics, Illustrative Problems on all the topics. Magnetostatics: Biot - Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux and Density, Maxwell's III and IV Equations for Magnetostatic Fields, Stoke's theorem, Illustrative Problems on all the topics.
UNIT – 3
Time Varying Fields: Faraday's Law and Transformer EMF, Displacement Current Density, Maxwell's Equations in differential and integral Forms, Illustrative Problems on all the topics. EM Wave Characteristics: Uniform Plane Waves–Definition and concept, General Wave Equations for lossy Media, Solution of wave equation: Relation Between E & H, Wave Propagation in free space, Lossless and Conducting Media, Wave Propagation in Good Conductors, Power of EM wave, Poynting's vector, Poynting's theorem, Illustrative problems on all the topics.
UNIT - 4
Transmission Lines: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristics Impedance, Propagation Constant, Phase Velocities, Lossless transmission lines, Distortion-less transmission lines, Input Impedance Relations, Reflection Coefficient, VSWR, Reflected and incident voltage and current relations, Types of loads: open-circuit, short circuit and matched line, illustrative Problems on all the topics.

Extended learning: Apply MATLAB to solve and understand problems in Electro static and magnetic fields.

TEXT BOOKS:

1. Matthew N. O. Sadiku, “Elements of Electromagnetics” 4th., Oxford niv. Press
2. William H. Hayt and John A. Buck, “Engineering Electromagnetics” 7th Ed., 2006, TMH.
3. John D. Ryder,” Networks, Lines and Fields” 2nd Ed., 1999, PHI.

REFERENCE BOOKS:

1. E.C. Jordan and K. G. Balmain, “Electromagnetic Waves and Radiating Systems” 2nd Ed., 2000, PHI.
2. Nathan Ida, “Engineering Electromagnetics” 2nd Ed., 2005, Springer (India) Pvt. Ltd., New Delhi.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://aemjournal.org/index.php/AEM/scope
2. https://www.tandfonline.com/toc/uemg20/current
3. IEEE Transactions on electromagnetic Compatibility
4. Progress in electromagnetic research

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/117/103/117103065/

3. https://www.classcentral.com/course/swayam-introduction-to-electromagnetic-theory-14146

4. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/

<table>
<tr><td>Course Title</td><td colspan="4">Signals and Systems</td><td colspan="2">Course Type</td><td colspan="2">HC Integrated</td></tr>
<tr><td>Course Code</td><td>B22EN0404</td><td>Credits</td><td colspan="2">4</td><td colspan="2">Class</td><td colspan="2">IV</td></tr>
<tr><td rowspan="6">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>4</td><td>5</td><td>5</td><td>42</td><td>28</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:
The course covers the fundamentals of signal and system analysis tackling both continuous-time (CT) and discrete-time (DT) systems. The course provides the necessary background needed for understanding analog and digital signal processing, automatic control, analog and digital communications, and probability and random processes. The course focuses on the study of linear time-invariant (LTI) systems and their analysis in the time domain or in the frequency domain. Fourier analysis in the course includes Fourier series for periodic continuous-time signals, the continuous-time Fourier transform (CTFT) and the discrete-time Fourier transform (DTFT). In addition the course includes a chapter on Z transform.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. Provide insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations.
2. Introduce time domain representation of Linear Time invariant Systems such as convolution Sum, Convolution Integral.
3. Provide understanding of signal representation in Fourier domain such as Fourier Series, Fourier transform, discrete time Fourier transform.
4. Provide insights into applications of Fourier transform and brief understanding of signal representation in Z-domain.

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the operations on Signals and summarize the properties of Systems.	1,2,3,4,5,9	2
CO2	Apply Convolution operation on an LTI System to calculate the output.	1,2,3,4,5,9	2
CO3	Represent the continuous and Discrete time periodic signals in frequency domain.	1,2,3,4,5,9	2
CO4	Represent the continuous and Discrete time Aperiodic signals in frequency domain.	1,2,3,4,5,9	2
CO5	Analyse the stability of Discrete time system by applying Z-transform.	1,2,3,4,5,9	2
CO6	Represent the discrete time system in Z-domain and determine the behaviour of Causal LTI system using properties of Z-Transform.	1,2,3,4,5,9	2

BLOOM'S LEVEL OF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓		✓		
CO6	✓	✓	✓			

COURSE ARTICULATIONMATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2				2					3	
CO2	3	3	2	1	2				2					3	

CO3	3	2	1	1	2				2					3	
CO4	3	2	1	1	2				2					3	
CO5	3	3	2	1	2				2					3	
CO6	3	2	1	1	2				2					3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY

Contents
UNIT-1 **Introduction to Signals and Systems** Definitions of signals and systems, Elementary signals, Classification of signals, properties of signals, Basic operations on signals, Classification of systems, Properties of systems, Sampling theorem (time domain).
UNIT-2 **Analysis of Linear Time Invariant Systems and Fourier Series** Time domain representation of LTI systems, Impulse response representation, Types of Convolution: Convolution Sum and Integral. **Fourier Representation of Periodic Signals:** CTFS and DTFS of basic signals.
UNIT-3 **Fourier Transforms and its applications** Fourier representation of CT signals – Definition of FT, FT of standard CT signals, Properties and their significance (with proof and problems), Inverse FT (only partial fraction method), Frequency response of continuous-time LTI systems, solving differential equations. Fourier representation of DT signals-Definition of DTFT, DTFT of standard DT signals, Properties (only statements and problems), Inverse DTFT (only Partial fraction method), Frequency response of discrete-time LTI systems.
UNIT-4 **Z-Transforms and its applications** Z -Transforms: Definition, Properties of Z transform (with proof and problems), ROC, Inverse Z – transforms (only partial fraction method), transform analysis of LTI Systems. Unilateral Z-Transforms and its application to solve difference equations.

PRACTICE SESSION:

Sl No	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Waveform generation	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
2	Perform Operations on Dependent Variable of a Signal.	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
3	Perform Operations on Independent Variable of a Signal.	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
4	To Calculate Signal Power and Signal Energy	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification

5	Linear Convolution	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
6	Fourier series	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
7	DT Fourier transform	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
8	Solve Any Given Difference Equation of An LTI System Without Initial Conditions.	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
9	Solve Any Given Difference Equation of An LTI System with Initial Conditions.	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification
10	Verification of Sampling Theorem.	Simulation of Mathematical model in Octave or MATLAB scripting	Program synthesis, Debugging, Simulation and Verification

TEXT BOOKS:

1. Simon Haykin, "Signals and Systems**",** John Wiley, India Pvt Ltd, Second Edition, 2018.
2. S Palani, "Signals and Systems", Springer International Publishing AG, Second Edition, 2021.
3. I J Nagrath, "Signals and Systems", Tata McGraw Hill, 3rd edition, 2010.

REFERENCE BOOKS:

1. Michael Roberts, "Fundamentals of signals and systems", TATA McGraw Hill, Second Edition ,2010
2. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson Education, Second Edition, 2019.
3. Benoit Boulet, "Fundamentals of Signals and Systems", Da Vinci Engineering Press, 2nd edition, 2006.
4.

JOURNALS/MAGAZINES:

1. https://ieeexplore.ieee.org/abstract/document/9244176
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
3. https://www.khanacademy.org/science/electrical-engineering/ee-signals
4. http://bonnie.ece.gatech.edu/book/TUTORIAL/tutorial.html
5. https://stanford.edu/~boyd/ee102
6. https://www.springer.com/journal/34
7. https://www.inderscience.com/jhome.php?jcode=ijsise
8. https://ieeexplore.ieee.org/document/1143815
9. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=79
10. https://www.ieee.org/membership-catalog/productdetail/showProductDetailPage.html?product=PER310-PRT

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/104/108104100/
2. https://nptel.ac.in/courses/117/101/117101055/
3. https://nptel.ac.in/courses/108/106/108106163/
4. https://www.coursera.org/courses?query=signals%20and%20systems
5. https://nptel.ac.in/courses/117/104/117104074/
6.

Professional Elective-1

Course Title	**INDUSTRIAL ELECTRONICS**				**Course Type**		SC	
Course Code	B22ENS411	Credits	3		**Class**		IV	
Course Structure	LTP		Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	3	3	3	42		**50%**	**50%**

COURSE OVERVIEW:

This course introduces the basic concepts of power semiconductor devices for controlling and converting electrical power. Principles of converter circuit analysis are introduced and design of power circuits including inverters, rectifiers.

COURSE OBJECTIVES:

The Course Objectives are:

1. Understand the operation of various Power S.C devices for industrial applications.
2. Familiarize the operation of controlled rectifiers with and without resistive load.
3. Make students to learn the single phase invertors, choppers and step-up choppers.
4. Understand the different sensors operation. And uses in automated manufacturing applications.
5. Familiarize with the operation and principles of the regulated power supply.

COURSE OUTCOMES(COs)

6. On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain and differentiate the operation of various Power S.C devices for industrial applications	1,2,3,4,6	1,2,3
CO2	Explain and analyze the operation of controlled rectifiers with and without resistive load.	1,2,3,4,6	1,2,3
CO3	Explain and analyze the single phase invertors, choppers and step-up choppers	1,2,3,4,6	1,2,3
CO4	Classify different sensors used in automated manufacturing applications and explain their operation.	1,2,3,4,6	1,2,3
CO5	Discuss the operation and principles of the regulated power supply.	1,2,3,4,6	1,2,3

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BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓		✓			
CO3	✓		✓			
CO4	✓	✓				
CO5				✓	✓	
CO6			✓	✓		

COURSE ARTICULATION MATRIX

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									2	3	2
CO2	3	3	2	1									2	3	2
CO3	3	3	3										2	3	2
CO4	3	2	1	1									2	3	2
CO5	3	2	3	3									2	3	2
CO6	3	2	3	3									2	3	2

COURSE CONTENT

THEORY

Contents
Unit 1
Power S.C devices --Power electronics: Power electronics devices.

Controlled rectifiers: Controlled rectifiers: SCR Half wave rectifier circuit, working with wave forms, mathematical analysis for resistive load - SCR Full wave rectifier circuit, working with wave forms, mathematical analysis for resistive load.
Unit 2 **Inverters:** single phase inverters, Choppers: principle of chopper operation, control strategies, step-up choppers
Unit 3 **Sensors :** sensors/Transducers, Principles ,classification of sensors, Parameters, Characteristics, Smart sensors, Primary sensors, Excitation, Amplification, Filters, Converters, Information coding/Processing, Data Communication, Standards for Smart Sensor Interface , The Automation.
Unit 4 **Power Supplies:** Block diagram of regulated power supply – A simple regulated transistorized power supply (circuit and working) – Principle and working of switch mode power supply (SMPS).

TEXT BOOKS:

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", P.H.I Private Ltd. New Delhi, Third Edition, 2004
2. P.S.Bimbra, “Power Electronics: devices, circuits, and applications”, Mohammed Rashid D Patranabis, “Sensors and Transducers”: 2nd edition.

REFERENCE BOOKS:

1. G.K. Mithal, “Industrial Electronics”, Khanna Publishers.

Course Title	**Python Programming and Applications**				**Course Type**		**SC**	
Course Code:	B23ENS412	**Credits**	**3**		**Class**		**IV Semester**	
Course Structure	**LTP**	**Credits**	**Contact Hours**	**Work Load**	**Total Number of Classes**		**Assessment in**	
	Lecture	**3**	**3**	**3**				
	Tutorial	**0**	**0**	**0**				
	Practice	**-**	**-**	**-**				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

This beginner-level course introduces students to the basics of programming using the Python programming language, and covers fundamental concepts such as data types, variables, control structures, and functions. Through practical exercises, students develop their skills in problem-solving and coding, and gain familiarity with popular libraries and frameworks used in Python development. By completing this course, students should have a solid foundation in Python programming, which is essential for learning Machine Learning. This course is ideal for those with little to no programming experience, who are interested in pursuing a career in data science and machine learning.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the basic concepts of programming, such as data types, variables, control structures, and functions.
2. Provide hands-on coding exercises to help students develop their problem-solving and coding skills.
3. Familiarize students with the Python programming language and its syntax, data structures, and built-in functions.
4. Teach students how to write simple Python programs and scripts to solve real-world problems.
5. Cover object-oriented programming principles and techniques that are essential for building larger-scale programs.
6. Introduce students to popular Python libraries and frameworks used in data science and machine learning, such as
   NumPy, Pandas, and Scikit-Learn.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Use the built-in data types and operators in python programming	1,2,3,5	1,2,3
CO2	Build functions and modules using python programming language.	1,2,3,5	1,2,3
CO3	Design object oriented programs using python class and objects.	1,2,3,5	1,2,3
CO4	Demonstrate and use the concept of inheritance for code reusability.	1,2,3,5	1,2,3
CO5	Demonstrate the basics of file handling including creating, opening, reading and writing to files.	1,2,3,5	1,2,3
CO6	Use advanced features like Numpy, Pandas, Matplotlib of python to develop ML applications.	1,2,3,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			✓			
CO2			✓			

CO3			✓			
CO4			✓			
CO5			✓			
CO6			✓			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2								2	1	2
CO2	3	2	3		3								2	1	2
CO3	3	2	3		3								2	1	2
CO4	3	2	2		3								2	1	2
CO5	2	2	2		3								2	1	2
CO6	3	3	3		3								2	1	2

Note:1-Low,2-Medium,3-Hig

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Introduction to Python: Features of python programming, application of python programming, Getting started, keywords, variables and identifiers, Python Indentation, statements and comments, Data types: numbers, list, tuple, strings, set, dictionary, type conversion, python I/O, python operators, branching and looping statements.
UNIT – 2
Python functions, Class and Objects: Python functions: Syntax of functions, arguments and return values, scope and lifetime of variables, python global keyword, python modules and packages. Classes and objects: Introduction to object-oriented programming, class, objects, attributes and methods, creating an object in python, self-parameter, constructors in python, deleting attributes and objects.
UNIT – 3
Inheritance, Exceptions and File handling Mechanisms: Inheritance: Python inheritance syntax, Examples on single inheritance and multiple inheritance. Exception Handling: Exceptions, exception handling and user defined exceptions. File Handling: Python file operations, directories.
UNIT – 4
Data Science with Python: Numpy: Introduction, arrays, indexing, slicing, shaping, sort and search operations. SciPy: Introduction and data manipulation using SciPy.

Pandas: Introduction, Series, DataFrames, Read CSV, Analyzing DataFrames.

Matplotlib: Creating plots, charts and visualization.

TEXT BOOKS:

1. Allen Downey, Think Python: How to Think like a Computer Scientist, Green Tea Press, 2nd edition, 2015.
2. Kenneth A. Lambert, Fundamentals of Python: First Programs (introduction to Programming), 2nd Edition, Cengage Learning, 2019.
3. Charles R. Severance, Python for everybody: Exploring data using python 3, 2nd Edition, Wiley India Pvt Ltd, 2020.

REFERENCE BOOKS:

3. John M. Zelle, PYTHON Programming: An Introduction to Computer Science, 3rd Edition, Franklin, Beedle& Associates.
4. Michael Dawson, Python Programming for the Absolute Beginners, 4th Edition, CENAGE Learning. Springer, Kent D. Lee, Python Programming Fundamentals, 3rd Edition.
5. John V. Guttag, Introduction to Computation and Programming using Python, 3rd Edition, MIT Press.

<table>
<tr><td>Course Title</td><td colspan="4">Computer Organization and Architecture</td><td colspan="2">Course Type</td><td colspan="2">SC</td></tr>
<tr><td>Course Code</td><td>B22ENS413</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Computer organization and architecture explore the fundamental concepts of computer operation, organization, and architecture. It gives an outline of computer software and hardware, and how the basic functional components are linked to create a comprehensive computer system. The course covers the basics of data transfer, I/O synchronization, interrupts, and Direct Memory Access techniques. Additionally, it includes the standards and bus protocols such as PCI, SCSI, and USB. This course will help the students to have a better idea about the data types, memory system and architecture inside the computer

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the architecture and functionality of the fundamental components of a computer.
2. Understand the machine level programming concepts
3. Define the input and output characteristics and its organization.
4. Outline the concepts of memory, their types and uses.
5. Demonstrate the arithmetic and logical operations and their associated circuits.

6. State the fundamental concepts of data transfer

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the architecture and functionality of the fundamental components of a computer.	1,2,3	1,2,3
CO2	Apply the machine level programming concepts	1,2,3	1,2
CO3	Illustrate the input and output characteristics and its organization.	1,2,3	1,2,3
CO4	Review the concepts of memory, their types and uses.	1,2,3	1,2
CO5	Compute the arithmetic and logical operations using their associated circuits.	1,2,3	1,2
CO6	Examine the fundamental concepts of data transfer	1,2,3	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply(L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1	√	√				
CO2	√	√				
CO3	√	√	√			
CO4	√	√				
CO5	√	√				
CO6	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1										2	2	1
CO2	3	2	1										2	2	
CO3	3	3	1										3	2	1
CO4	3	2	1										3	2	
CO5	3	2	1										3	2	
CO6	3	2	1										3	2	

Note: 1-Low,2-Medium,3-High

Course Contents

Contents
UNIT - 1
Basic Structure of Computers: Computer types, Functional units, Basic operational concepts, Bus structures, Performance-processor clock, Basic performance equation, clock rate, performance measurement. Machine Instructions and Programs: Memory location and Addresses, Memory Operations, Instructions and instruction sequencing, Addressing modes, Assembly language, Stack and Queues, Subroutines.
UNIT - 2
Input/ Output Organization: Accessing I/O Devices; Interrupts; enabling and disabling interrupts, Handling multiple devices, Device requests, Exceptions, Direct Memory Access, Buses-Synchronous Bus, Asynchronous Bus, Interface Circuits-Parallel Port, Serial Port, Standard I/O interfaces.
UNIT – 3
The Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cache Memories, Virtual Memories, Address Translation, Associative Mapped TLB, Secondary Storage-Magnetic Hard Disks.
UNIT – 4
Arithmetic and Basic Processing Unit: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers. Fundamental Concepts, Register transfers, Performing an Arithmetic or Logic Operation, Fetching a word from memory, Storing a word in memory.

TEXT BOOKS:

1. Carl Hamacher, Z Varnesic and S Zaky, "Computer Organization", Fifth Edition, McGraw Hill 2002.
2. Computer Architecture: A Quantitative Approach (5th edition) by J.L. Hennessy and D.A. Patterson (Morgan Kauffmann Publishers)

REFERENCE BOOK:

1. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
2. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
3. Vincent P. Heuring& Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education,2004.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. IEEE Computer Architecture Letters: A peer-reviewed journal that focuses on computer architecture and organization.
2. ACM Transactions on Computer Systems (TOCS): A journal that covers a wide range of topics related to computer systems, including computer organization.
3. IEEE Transactions on Computers: This journal publishes research articles on computer architecture and organization, among other computer-related topics.
4. Communications of the ACM (CACM): A renowned magazine that covers various aspects of computing, including computer organization.
5. Memory Organization and Assembly Language Programming - ScienceDirect
6. Interrupt Handling - an overview | ScienceDirect Topics

SWAYAM/NPTEL/MOOCs:

Computer architecture and organization - Course (nptel.ac.in)

https://youtu.be/e9w_XERZ2UM https://youtu.be/3ye2OXj32DM https://youtu.be/8s4b8mYCMAE https://youtu.be/HWwNTWY1rxo https://youtu.be/G0rbpTX_ytE https://youtu.be/3RfqkVyvnnc

<table>
<tr><td>Course Title</td><td colspan="4">Linear Integrated Circuits Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22EN0405</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="6">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td>Theory</td><td>Practical</td><td>IA</td><td>SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>-</td><td>28</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW

This laboratory course is introduced for the students to explore the applications in linear ICs. The students will learn filtering concepts of various filters. Precision rectifier concepts are also introduced. Fundamental concepts in system design is introduced by designing waveform generators and PLL. The students also design the applications using industry standard simulators.

COURSE OBJECTIVE (S):

The objectives of this course are:

1. Understand and design various applications of Op-Amp and measure the physical parameters.
2. Structured systematically to upgrade graduates skills and knowledge to the more advanced in- depth skills and knowledge in electronics.
3. Infer the DC and AC characteristics of operational amplifiers and design the linear and non-linear applications using operational amplifiers.
4. Simulation and design of electronic circuits using SPICE or other analog simulators

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design and test Op-amp Instrumentation amplifier	1,2,3,4,5,9,10	1,2,3

CO2	Design and test second-order low-pass and high pass filters using op-amp	1,2,3,4,5,9,10	1,2,3
CO3	Design and test Schmitt Trigger for different values of UTP and LTP	1,2,3,4,5,9,10	1,2,3
CO4	Design and test the waveform generators using op-amp	1,2,3,4,5,9,10	1,2,3
CO5	Construct op-voltage regulators and test for line and load regulations	1,2,3,4,5,9,10	1,2,3
CO6	Demonstrate linear and non linear applications using simulator tools.	1,2,3,4,5,9,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2					2	2		3	3	1
CO2	2	2	2	2	2					2	2		3	3	1
CO3	2	2	2	2	2					2	2		3	3	1
CO4	2	2	2	2	2					2	2		3	3	1
CO5	2	2	2	2	2					2	2		3	3	1
CO6	2	2	2	2	2					2	2		3	3	1

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

PRACTICE SESSION:

	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Study the characteristics of negative feedback amplifiers	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
2	Design and Test of half wave and full wave precision rectifier	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
3	Design and Test Instrumentation amplifier.	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
4	Design ,simulation and discrete circuit testing of second-order low-pass filter and high-pass filter	PC with Multisim simulation software, Analog Discovery and design equations	Design, simulation and circuit debugging. Working in a team
5	Design ,simulation and discrete circuit testing of second-order bandpass	PC with Multisim simulation software, Analog Discovery and design equations	Design, simulation and circuit debugging. Working in a team
6	Design ,simulation and discrete circuit testing of Schmitt Trigger circuit for the given values of UTP and LTP	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team.
7	Design ,simulation and discrete circuit testing of Astable multi-vibrator circuits using IC 555 for given frequency and duty cycle	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
8	Design ,simulation and discrete circuit testing of a of 4-bit DAC.	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
9	Design ,simulation and discrete circuit testing of a rectangular and triangular wave generator	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
10	Design ,simulation and discrete circuit testing of integrator and differentiator circuit	PC with Multisim simulation software,CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team

11	Design ,simulation and discrete circuit testing of a voltage regulator circuit using op-Amp	PC with Multisim simulation software,CRO, Function Generator, and design equations	Design, simulation and circuit debugging. Working in a team
1 2	Demonstration of PLL	PC with Multisim simulation software, CRO, Function Generator, and design equations	Design ,simulation and circuit debugging. Working in a team

TEXT BOOKS:

1. David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004 2. D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006

3. R. Gayakwad, "Op-amps and Linear Integrated Circuits" (4/e), PHID. A. Bell, Solid state Pulse Circuits (4/e), PHI, 2009

REFERENCE BOOKS:

1. Thomas L. Floyd, David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1999

2. Bruce Carter," Op Amps for Everyone", ISBN: 978-0-12-391495-8, Fourth Edition.

3. BIS, ISO standards and Datasheet

JOURNALS/MAGAZINES

1. IEEE transactions on Circuits and Systems

2. https://en.wikipedia.org/wiki/List_of_linear_integrated_circuits

3. http://www.fairchildsemi.com/an/AN/AN-88.pdf

4. https://www.onsemi.com/pub/Collateral/AN-118.pdf.pdf

5. https://www.onsemi.com/pub/Collateral/AN-140.pdf.pdf

6.https://web.archive.org/web/20130502174545/http://www.fairchildsemi.com/an/AN/AN-340.pd

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/108/108108111/
2. https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2
3. https://www.coursera.org/lecture/electronics/2-5-active-filters-L2ASa

4. https://www.coursera.org/lecture/sensors-circuit-interface/3-basic-amplifiers-sojqu
5. https://www.coursera.org/lecture/internet-of-things-sensing-actuation/op-amps-kxEOi
6.https://static1.squarespace.com/static/60494675b50d044ae4a81842/t/604a10a95e0cc12e7de634d5/16154666 69126/analog_circuit_design_coursera.pdf

<table>
<tr><td>Course Title</td><td colspan="4">Analog Communication Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B22EN0406</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="7">Course Structure</td><td></td><td></td><td>Contact</td><td>Work</td><td rowspan="4" colspan="2">Total Number of Classes Per Semester</td><td rowspan="4" colspan="2">Assessment in Weightage</td></tr>
<tr><td>LTP</td><td>Credits</td><td>Hours</td><td>Load</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td colspan="2" rowspan="2"></td><td colspan="2" rowspan="2"></td></tr>
<tr><td>-</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Total</td><td>1</td><td>2</td><td>2</td><td>Theory</td><td>Practical</td><td>IA</td><td>SEE</td></tr>
<tr><td></td><td>Total</td><td>1</td><td>2</td><td>2</td><td></td><td>28</td><td>50 %</td><td>50 %</td></tr>
</table>

Analog communication laboratory is meant for experiments at the instructional level for undergraduate students. In this course students will conduct experiments to demonstrate the frequency characteristics of an IF amplifier, Amplitude modulation and demodulation, DSB-SC modulation and demodulation, pulse modulation schemes, frequency modulation and demodulation, Pre-Emphasis and De-Emphasis, mixer design. Simulation of amplitude modulation, AM-DSBSC modulation and frequency modulation using LabVIEW/MATLAB programming software. These Experiments helps students tocorrelate the concepts studied in theory and the results obtained from experiments.

COURSE OBJECTIVES:

The objectives of this course are to :

1. Demonstrate the basics of Analog Modulation/Demodulation principles
2. Provide the understanding of Pulse Modulation/Demodulation Schemes
3. Introduce the basics of Phase locked Loop (PLL), Pre-Emphasis and De-Emphasis
4. Demonstrate AM and FM techniques using LabVIEW/MATLAB programming software

COURSE OUTCOMES

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Design an IF Amplifier to select a particular signal in super heterodyne Receiver	1,2,3,4,5,9,10	1,2,3
CO2	Simulate and test AM/FM Modulators and demodulators	1,2,3,4,5,9,10	1,2,3
CO3	Design and test PAM,PWM, PPM modulators and Demodulators	1,2,3,4,5,9,10	1,2,3
CO4	Design and test Frequency Synthesizers using PLL	1,2,3,4,5,9,10	1,2,3

CO5	Design and test Pre-Emphasis and De-Emphasis of a given signal.	1,2,3,4,5,9,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember(L1)	Understand (L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1				1	1			1	2	1
CO2	3	3	3	2	1				1	1			3	2	1
CO3	3	3	3	2	1				1	1			2	3	3
CO4	3	3	3	2	1				1	1			3	2	1
CO5	3	3	3	2	1				1	1			2	3	2
CO6	3	3	3	2	1				1	1			3	3	2

Note:1-Low,2-Medium,3-High

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools andTechniques	Expected Skill /Ability
1	To Study the Frequency Characteristics of IF Amplifier.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2	To Generate Amplitude Modulationand Demodulation.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Simulation of Amplitude Modulationand Demodulation using LABVIEW software.
3	AM-Double Sideband Suppressed Carrier (DSBSC) Generation and Detection	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Simulation of DSBSC modulation and demodulation using LABVIEW software.
4	Design and test Pulse Amplitude Modulation and Demodulation circuit.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
5	Design and test Pulse Width Modulation and Demodulation.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
6	Design and test Pulse Position Modulation and Demodulation.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team

7	To Generate Frequency Modulatedwave for modulation index (β >1)	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Simulation of Frequency Modulation using LABVIEW software
8	Frequency Synthesis using PLL IC 565.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
9	Design of a Mixer circuit using BJT.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
10	To Illustrate Pre-Emphasis and De-Emphasis of a given signal.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team

EXTENDED LEARNING: Simulate Analog communication Experiments using LABVIEW software**.**

TEXT BOOKS:

1. Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley, 3rd Edition 2003.
2. Simon Haykins, "Communication Systems", John Willey 4th Edition, 2001.

REFERENCE BOOK:

1. B. P. Lathi, "Modern digital and analog Communication systems", Oxford University press, 3rd Edition, 2005.
2. Kennedy, Davis," Electronic Communication Systems ", Tata Mcgraw-Hill, 4th Edition, 1999.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://ieeexplore.ieee.org/document/1456366
2. https://ieeexplore.ieee.org/abstract/document/1054507
3. https://onlinelibrary.wiley.com/toc/10991131a/4/1
4. https://www.youtube.com/watch?v=00ZbuhPruJw
5. https://www.youtube.com/watch?v=beFoCZ7oMyY
6. https://www.youtube.com/watch?v=A6BRXPqxya0

SWAYAM/NPTEL/MOOCs:

1.https://www.coursera.org/lecture/satellite-communications/from-analog-to-digital-AUNu1

2. https://www.classcentral.com/course/swayam-analog-communication-13893

3. https://onlinecourses.nptel.ac.in/noc20_ee69/preview

Course Title	Course Based Project on Linear Integrated Circuits				Course Type			
Course Code	B22EN0407	Credits	1		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in	
	Lecture	0	0	0				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**		**28**	**50 %**	**50**

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because, this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

COURSE OBJECTIVES:

The objectives of this course are:

1. Integrate knowledge and skills learnt from theory concepts to build projects
2. Design solution to Engineering/real time problems

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Build hardware to solve real time /Engineering problems	1,2,3,4,5,9, 10,11,12	1,2,3
CO2	Apply appropriate technique to solve Engineering problems	1,2,3,4,5,9, 10,11,12	1,2,3
CO3	Present the innovative ideas in building the projects	1,2,3,4,5,9, 10,11,12	1,2,3
CO4	Develop an individual as responsible team member	1,2,3,4,5,9, 10,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				3	3	1	1	2	2	1
CO2	3	3	3	3	2				3	3	1	1	3	2	
CO3	3	3	3	3	2				3	3	1	1	3	3	2
CO4	3	3	3	3	2				3	3	1	1	3	3	2

Note:1-Low,2-Medium,3-High

GUIDELINES TO CARRY OUT PROJECT

1. The project is carried out by team of two or three students (student team).
2. Each Student team is guided and monitored by Faculty, the Course coordinator for Linear Integrated Circuits will be the Coordinator for Course based Project (CBP) Course.
3. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.
4. The activities for each week will be assigned.
5. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.
6. In the laboratory training, students carry out practices according to the project stages.

ASSESSMENT AND EVALUATION:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise by Faculty in charge.

2.The external evaluation is made on written reports, oral presentation and demonstration of project results with developed model at the end of the semester by Examiner.

Course Title	**Professional Ethics**				**Course Type**	**FC**	
Course Code	B22CS0301	Credits	2		Class	III Semester	
		Credits	Contact	Work	Total Number of		
	Lecture	2	2	2	Classes Per Semester	Assessment in	
	Tutorial	-	-	-			
	Practice	-	-	-		CIE	SEE
	Total	2	2	2	28	50%	50%

COURSE OVERVIEW:

The course enables e the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

COURSE OBJECTIVE S:

1. Understand the professional Rules of conduct for Engineers.
2. Appreciate codes of conduct, professional Rules of conduct.
3. Recognize the conflict of interest and Develop strategies

4. Understand the importance of communication with all stakeholders.
5. Apply practical strategies for handling ethical dilemmas.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understanding basic purpose of profession, professional ethics and various moral and social issues.	8,9,10	
CO2	Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer	8,9,10	
CO3	Acquiring knowledge of various roles of Engineer In applying ethical principles at various professional levels	8,9,10	
CO4	Professional Ethical values and contemporary issues	8,9,10	
CO5	Apply practical strategies for handling ethical dilemmas	8,9,10	
CO6	Appreciate codes of conduct, professional Rules of conduct	8,9,10	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			
CO6	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2	2					
CO2								3	2	2					
CO3								3	2	2					
CO4								3	2	2					
CO5								3	2	2					
CO6								3	2	2					

Note:1-Low,2-Medium,3-High

COURSE CONTENT

UNIT – 1

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – 2

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT- 3

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

UNIT- 4

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, OxfordUniversityPress,2015.
2. Ethics in Engineering Practice &Research, CarolineWhitbeck,2e, Cambridge University Press 2015.

REFERENCE BOOKS:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr.,Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: ManuelGVelasquez,6e,PHI, 2008.

Evaluation pattern:

1. Internal Assessment-1 will be conducted as a MCQ test for 20 Marks which covers Unit-1 and Unit-2 of the syllabus. This exam will be conducted during IA-1 examinations slot and 5 marks will be assigned to the first assignment
2. Internal Assessment-2 will be conducted as a MCQ test for 20 Marks which covers Unit-3 and Unit-4 of the syllabus. This exam will be conducted during IA-2 examinations slot and 5 marks will be assigned to the second assignment.
3. Semester End Exam will be conducted as a MCQ exam for 50 Marks which covers unit-1, unit-2, unit-3 and unit-4. This exam will be conducted during semester end examination slot.

Course Title	Introduction to Design Thinking				Course Type		FC	
Course Code	B24CI0309	Credit	01		Class		III/IV	
Course Structure	LTP	Credit	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**-**	**32**	**50%**	**50%**

COURSE OVERVIEW:

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world

In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

COURSE OBJECTIVES:

The objectives of this course are to:

1. impart knowledge on design thinking process for understanding designs.
2. provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. Inculcate attitude to solve societal problems using design thinking tools.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop problem solving skills.	1,2,9,10,12	1,2
CO2	Students will develop human-centric mindset while designing, innovating, developing, and testing solutions for new products, services, and processes	1,2,9,10,12	1,2

CO3	Enhance communication and understanding between the team members.	1,2,9,10,12	1,2
CO4	Enhance creative thinking and apply for solving real world problems.	1,2,9,10,12	1,2
CO5	Understand the role of innovation in the digital era and drive disruptive innovation.	1,2,3,5,9,10	1,2
CO6	Develop the ability to create and test prototypes that are customer-centric and innovative	1,2,3,4,5,9,10	1,2

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	2	
CO2	1	3							2	3		2	1	2	
CO3	1	2							3	2		3	1	2	
CO4	1	2							3	2		2	1	2	
CO5	2	2	3		2				3	3		2	2	3	
CO6	2	2	2	2	2				3	2		2	2	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENTS: THEORY:

Contents
Design Thinking Process: Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc, identifying the target users for the problem selected, Survey on existing solutions for the problem identified. Empathizing: Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies. Defining the problems: POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc What is a prototype? - Prototyping as a mind set, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype

Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

PRACTICE:

Sl.No	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human cantered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop ma perception king problem statements from user
6	Presentation by student teams	PPT	Develop ability to express their views

Course Title	**Environmental Science**				**Course Type**		**MC**	
Course Code	**B22AS0403**	**Credits**	**0**		**Class**		**III/IV Semester**	
Course Structure	LTP	Credits	Contact	Work	Total Number of Classes		Assessment in	
	Theory	0	1	1				
	Tutorial	-	-	-	Theory	Practial	CIE	SEE
	Practical	-	-	-				
	Total	**0**	**1**	**1**	**16**	**-**	**50 %**	**50 %**

Course Overview: Environmental Science is focussed on a holistic understanding of earth systems in order to learn from the past, comprehend the present and influence the future. It is the study of how physical, chemical and biological processes maintain and interact with life, and includes the study of how humans affect nature. As environmental science is at the cross-roads of the natural sciences, it provides an enriching alternative to a single-subject honours degree, and can open the door to an exciting range of career options. This approach enables us

to tackle necessary problems, such as ensuring that human needs are met in a sustainable way, so that everyone has access to clean water and air, and the resources required for agriculture and industrial activity.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Familiar with current and emerging environmental engineering and global issues and have an understanding of ethical and societal responsibilities.

2. Recognize the need for engaging in life-long learning.

3. Study various types of energy (conventional & non-conventional) resources and natural resources.

4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.

5. Know about sources, effects and control measures of environmental pollution, degradation, and waste management.

6. Explore the ways for protecting the environment.

COURSE OUTCOMES (COs):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection.	7,9,10	**1**
CO2	List the causes, effects & remedial measures of environmental pollution, degradation & find ways to overcome them by suggesting the pollution controlled products.	7,9,10	**1**
CO3	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	7,9,10	**1**
CO4	Critically analyse the ecological imbalances and provide recommendations to protect the environment.	7,9,10	**1**
CO5	Explore the condition of environmental degradation and waste management techniques and take promising measures to make our environment eco-friendly.	7,9,10	**1**
CO6	Identify new methodologies for conservation of our natural resources and ecosystem.	7,9,10	**1**

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓				
CO3	✓					
CO4	✓					
CO5	✓	✓				
CO6	✓					

COURSE ARTICULATION MATRIX:

CO #/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1							2		2	2			1		
CO 2							2		2	2			1		
CO 3							3		2	2			1		
CO 4							3		2	2			1		
CO 5							2		2	2			1		
CO 6							3		2	2			1		

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:

THEORY:

Contents

UNIT-1

Environment and Environmental Protection

Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment. **Environmental protection:** Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations.

UNIT-2

Environmental pollution, degradation & Waste management:

Environmental Pollution: Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Automobile Pollution-Causes, Effects & control measures.

Environmental degradation: Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Waste management: Municipal solid waste, Bio-medical waste and Electronic waste (E-Waste).

UNIT-3

Energy & Natural resources:

Energy: Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, Hydrogen as an alternative as a future source of energy.

Natural resources: Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance. Forest wealth - Importances, Deforestation-Causes, effects and controlling measures

UNIT-4

Ecology, ecosystem & field work:

Ecology - Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Components of ecosystem-abiotic and biotic.

Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity.

Field work: Visit to waste water/sewage treatment plant (STP) and biogas plant at REVA university campus, and/or Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

TEXT BOOKS:

1. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.

2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies", Wiley India Private Ltd., New Delhi, 2nd Edition, 2014.

3. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, 2nd Edition, 2008.

4. Dr.S.M.Prakash, "Environmental Studies", Elite Publishers, Mangalore, 2nd Edition, 2009.

5. Rajagopalan R, "Environmental Studies – from Crisis to cure", Oxford University Press, 3rd Edition, 2016.

EXAMINATION PATTERN:

The course is Mandatory course, As per the regulations 23-24 no IA tests or assignments for the course evaluation. Semester End Examination question paper is of MCQ pattern set for maximum marks of 50. Marks obtained is scaled down to 25.

LINKS FOR EVS ONLINE RESOURCES

Link for online	**Title of the course**	**Course Duration**
https://www.classcentral.com/course/swayam-environmental-studies-14042	**Environmental Studies**	**12 Weeks** **Free Online**
https://www.edx.org/course/introduction-to-environmental-science-2?index=product&search_index=product&webview=false&campaign=Introduction+to+Environmental+Science&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science	**Introduction to Environmental Sciences**	**5hrs/Week** **For Weeks**
https://www.coursera.org/specializations/environmental-science?action=enroll	**Introduction to Environmental Science Specialization**	**5hrs/Week** **12 Weeks**

Annexure- 5

School of Electronics and Communication Engineering

GUIDELINES FOR THE IMPLEMENTATION OF FINAL YEAR PROJECT

2022-26 batch of all B. Tech Programs

Major project or final year Project is team (Group)/ Individual project, which is to be executed in 7th and 8th semesters. It is a mandatory course for students to be awarded with B. Tech degree in their respective programs. The students are expected to undergo research studies that relate to this course.

The Major project consists of two phases: Major project phase 1 in 7th semester is a prerequisite for Major project Phase 2 in 8th semester.

The objective of the Major project is to enhance the student's knowledge and skills in solving problem through structured project research in order to produce a competent and productive engineer.

Upon completion of Major project, the student should be able to:

1. Identify and describe the problem and scope of the project.
2. Collect, analyze and present data into meaningful information using relevant tools.
3. Select plan and execute a proper methodology in problem solving.
4. Work independently and ethically
5. Present the results in written and oral format effectively
6. Identify basic entrepreneurship skills in project management

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P12	PSO1	PSO2	PSO3
CO1		3		3		3	3	3			3		3	2	3
CO2	3	3		3								3	3	2	3
CO3	3		3	3		3	3		3				3	2	3
CO4	3		3	3	3				3			3	3	2	3
CO5					3			3	3	3		3	3	2	3
CO6									3	3	3	3	3	2	3

The Major project is to **learn and experience the process** of conducting agood research project. The various activities that takeplace in the process are

1. Formation of Problem statement
2. Objective of the Project
3. Scope
4. Literature Review
5. Methodology
6. Result, Analysis and Discussion

The above points can be briefly described in following paragraphs:

1. Formation of Problem statement: A problem statement is a brief statement of the problems, which initiate the research questions or design ideas. Some of the points that could be highlighted are:

I. What is the issue/Problem/question that we want to address?
II. Why need to address the issues?
III. How the proposed methodology can solve the issues?

2. Objective of the Project:

Objective is set of clear goals of what we want to accomplish by doing the project/research work. Student should statethe technical objective of the project with respect to evaluate the performance of the design. Measurable verbs are to be included while framing the objectives.

3. Scope

Scope sets a clear boundary with respect to time, geography, environment, function etc. of project work to provide a common understanding of the project among students, lecturer, panels. Scope makes project achievable and realistic by defining the limits and constrains of the study

4. Literature review

A literature review discussed published information in a particular subject area. The purpose of a literature review is to summarize and synthesize the ideas of others. When we write a literature review, it usually consists of 3 main sections:

- Introduction section that describe the topic of the review.
- Body section, which contain the discussion of sources.
- Conclusions from the discussion of sources and recommendations

The discussion of the sources could be arranged chronologically, thematically or methodologically or in combination of any of them. In the discussion, students should:

- Be clear of the items that need to be discussed. It can be a variable, a technique, or different design decision.
- Make comparisons and give technical comments. Summary of the comparison could be tabulated or shown in graphs to clarify the differences.
- For engineering design, discuss on the tradeoff a particular design decision.

5. Methodology

Methodology is the part where we design and execute our research. We design our research methodology by asking the following questions:

- What is the objective of the study? Like given a new design idea, we want to evaluate the performance of the new design in terms of its sensitivity, accuracy, processing time etc.
- What do we want to measure? For example time, storage size, current, cost, sensitivity, accuracy etc.)
- How do we perform the measurement?
- What are the tools :simulation software or equipment required for the experiment
- How are the measurements going to be recorded? What is the procedure of the experiment?
- What error, situations, or part of the procedure that we design that could interfere with the measurements and how we could overcome them?
- How do we analyze the result of the experiment? What kind of statistical tools/calculations/graphs/tables/figures could we used in order to make the data meaningful?

6. Result, Analysis and Discussion

The results of the study/experiments in the forms of graphs or tables that summarize measurements (data). At this stage of the research process, we are expected to discuss the results. Examples of points of discussion are:

- Statement of how the variable of interest changes with the change ofanother variable and whether the trend is expected.
- Academic interpretation of the result (i.e. with proof, comparisonwith other

works, intelligent guess).

- Significance (its impact to the world) and implication of findings.
- Possible applications.

Implementation Method and Guideline

I. The student teams after approved by the coordinators and panel are allotted with project supervisors/guides as per the specialization of the faculty. The teams are advised to submit the problem title and the domain for the allotment of guides.

The duties of project supervisors/guides include:

- Supervise project implementation and progress.
- Provide guide for continual improvement.
- Verify student's logbook in each meeting.
- Evaluate student works and outcomes.
- Ensure that the title given to students as well as projects objectives remain unchanged without prior approval.
- Verify any related final year project forms.
- Commit to FYP implementation.
- Execute any related tasks given by project coordinator.

Any supervisors who tend to change project title and project scope after week 4 must seek approval project panel.

II. Project Title Registration:

The project team has to present 5 or 6 project titles to the supervisor/guide, Based on the confidence level of the team the team can choose a project. Student must fill the final year project Title Registration Form and to be signed by supervisor/guide**.**

III. Project Proposal:

Project Proposal Form submitted by team t o his/her supervisor/guide prior tothe commencement of the projects. The form must include a title, abstract , objectives /aim (or goal) and scope of the project, literature review and proposed methodology. The first proposal is submitted before the proposal presentation (seminar) for panel assessment. Then after Presentation, student must resubmit the proposal after correction complying the panel comments.

IV. First Seminar – proposal presentation –Phase 1

Project team will be required to make a brief presentation about the project proposal, to ensure that they are entitled to present their findings; they need approval from their supervisor/guide.

The presentation slideshow should cover the following:

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.

- Literature survey and theory.

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critics and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

V. Second Seminar - Project Presentation-Phase 1

At the end of final year project 2 , team will be presenting the progress of their project .Once again, to ensure that they are entitled to present their findings, The verified form must be submitted to the panels during the presentation.

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.
- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critic and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

The project demonstration (if any) takes place right after the presentation on the same day of presentation schedule.

The evaluation rubrics for Major presentation Phase 1- in 7th semester is as follows.

overview of the project (5)	Problem statement (5)	Problem objectives (5)	Literature survey (5)	Methodology(5)	reference (5)	Independent Learning (10)	Oral Presentation (10)	Total(50)

Guidelines for Major presentation Phase 2- Eight Semester

In continuation of the final year project phase II, the team will be concentration on implementation of the propose methodology followed in the project. Result and analysis.

IV. First Seminar – proposal presentation –Phase 2

Project team will be required to make a brief presentation about the project proposal, to ensure that they are entitled to present their findings; they need approval from their supervisor/guide.

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.
- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critics and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

V. Second Seminar - Project Presentation-Phase 2

At the end of final year project 2 , team will be presenting the progress of their project .Once again, to ensure that they are entitled to present their findings, The verified form must be submitted to the panels during the presentation.

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.
- Results and discussions
- Future scope
- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critic and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

The project demonstration (if any) takes place right after the presentation on the same day of presentation schedule.

VI. Final Draft Report

Upon completing the project, a draft report should be submitted to project guide and the panel for evaluation. The report must contain an updated progress report, and all information as pre-determined by the Project coordinator.

VII. Final Report

Complete report (**6 copies with CDs)** must be submitted to the faculty after the draft report has been evaluated and corrected by the project guide. This report is a corrected form (if any) of draft report which sent to the panel or project guide beforehand. It must be a press-bind with standard front cover

VIII .Evaluation Scheme

Students undertake final year project must go through seminar (project presentation) and produce proposal/report for each part of the project. Students areevaluated by their project guide and also by panels.

Project Supervisor/ Guide Evaluation

Individual supervisor/guide evaluates students based on peer-to-peer meeting and weekly progress. Logbook as an evidence to a student task may also contribute a portion of marks.

Panel Evaluation

Panels evaluate the project presentations, as well as final report and project demonstration in final year project.

Evaluation Rubrics:

overview of the project (5)	Problem statement (5)	Problem objectives (5)	Literature survey (5)	Methodology(5)	Results and discussions(10)	References(5)	Oral Presentation (05)	Demonstration of project(5)	Total(50)

Final year Project Activities Calendar

Committee produced an activity calendar to help students plan and execute their project within the semester. The followings are general activities for Phase 1 and Phase 2.The exact dates shall be informed at the beginning of each semester. However the dates are subject to change depends on the current Academic Calendar.

Phase 1 Calendar – Semester 7

ACADEMIC WEEK	ACTIVTY
1	Group Formation
2	Topic and Guide Selection
3	Literature Survey
4	Title Finalization
5	Phase-0 presentation with Title scrutinization
06	Updating of Title
07	Hardware and Software components finalization
08	Weekly Project progress to guide
09	Weekly Project progress to guide
10	Weekly Project progress to guide
11	Weekly Project progress to guide
12	Phase-1 PPT preparation and Report (Chapter: Introduction, Literature Survey and Methodology)
13	Verification and Printing (Soft binding of report)
14	Phase -1

Phase 2 Calendar – Semester 8

ACADEMIC WEEK*	ACTIVITY
1	Weekly Project progress to guide
2	Weekly Project progress to guide
3	Progress presentation
4	Weekly Project progress to guide
5	Weekly Project progress to guide
06	Weekly Project progress to guide
07	Weekly Project progress to guide
08	Project Model Demonstration
09	Expert Talk on Research Paper Writing
10	Paper writing
11	Paper writing and Plagiarism checking
12	Phase-2 PPT preparation and Report (Chapter: All Chapters)
13	Verification and Printing (Hard binding of report)
14	Phase -2 presentation

REVA UNIVERSITY

Log Book

Project Diary

Group No.	

Project Title

Project Phase:

	PHASE I	SEM VII
	PHASE II	SEM VIII

Academic Year	

School of Electronics and Communication Engineering
REVA University Bangalore
PROJECT GROUP MEMBER DETAILS:

Sr. No.	Roll No.	Name	Mobile No.	Sign
MEMBER1				
MEMBER2				
MEMBER 3				
MEMBER4				

Supervisor: _____
(Sign with Date)

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LIST OF BASE & REFERENCE PAPERS

Sr. No.	Paper Title	Name of Author	Month And Year of Publication
01			
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REV:0	PROJECT WEEKLY MONITORING SHEET - WEEK 1	PRO-05

STATUS	
TO DO	

Monitoring Process Criteria:

Sr. No.	Grading Criteria	Max Marks	Member1	Member2	Member3	Member4
1.	Timely Completion	2				
2.	Involvement & Coordination	2				
3.	Level of Understanding	2				
4.	Proof of Work Done	2				
5.	Attendance (Member Sign)	2				
	Weekly Score	10				
	Supervisor (Sign)	1``				

Note : Final Cumulative Weekly score will be added in the Presentation ONE Evaluation Sheet.

REV:0	PROJECT PRESENTATION-ONE EVALUATION SHEET				PRO-06A
Sr. No.	Cumulative Weekly Score	Presentation Skills of Member	Quality of Presentation or Demonstration	Total Score (Max out of 30)	
	(10)	(10)	(5)	(25)	(50)
Member 1					
Member 2					
Member 3					
Member 4					

Note :

1) Cumulative Weekly score out of 10 will be added from previous Weekly Monitoring Sheets.

Improvement Remark :

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PROJECT GUIDE **Director**